Engineering and Mining Journal

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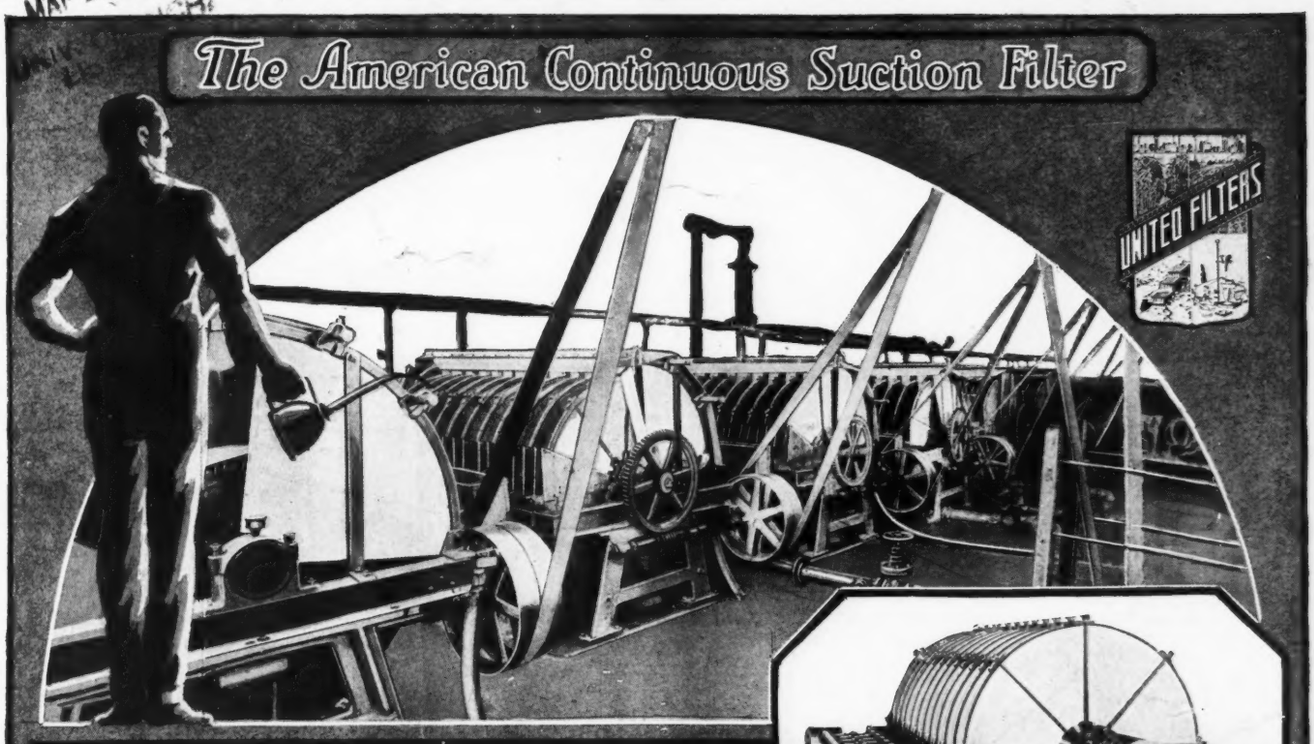

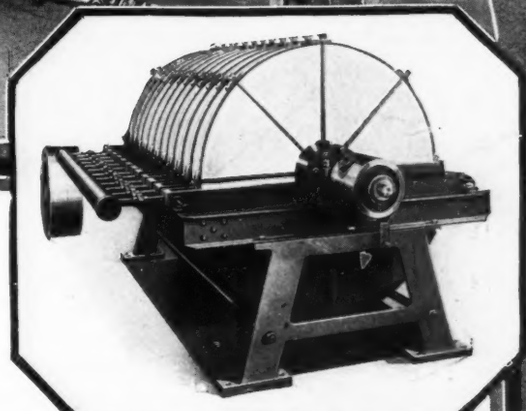

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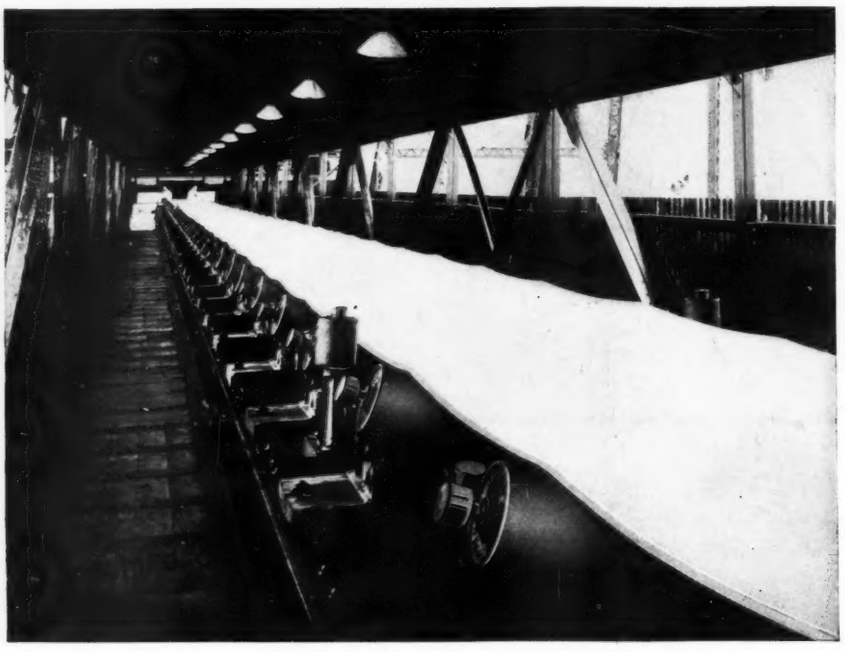

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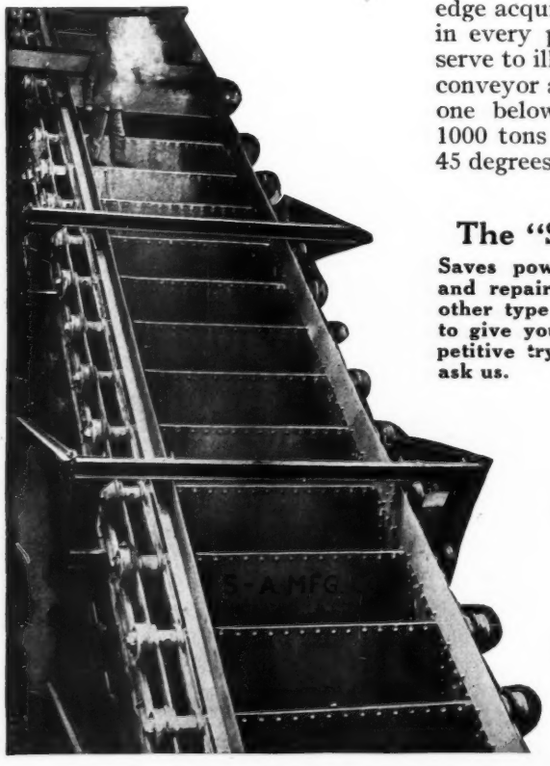

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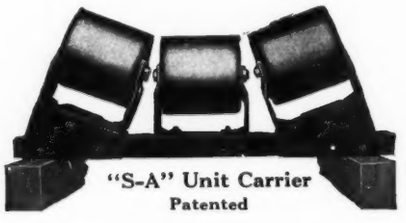

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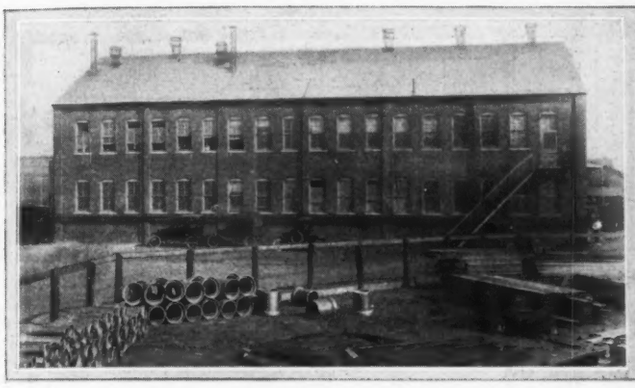


FIG. 1. BUILDING IN WHICH NEW LABORATORY IS HOUSED AT CHROME PLANT

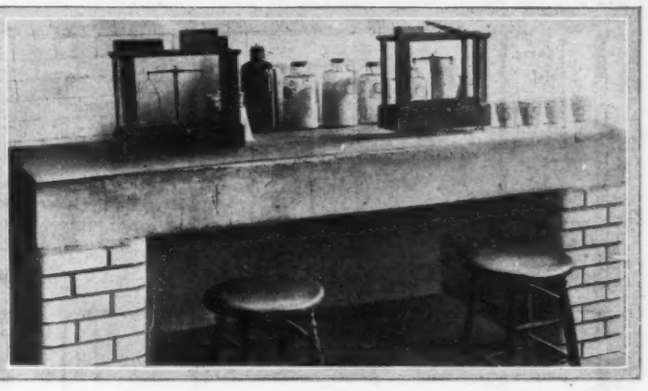


FIG. 2. BALANCE TABLES CONSIST OF 10-IN. CONCRETE SLABS SUPPORTED ON TILE PIERS

U. S. Metals Refining Co.'s New Laboratory at Chrome, N. J.

By B. B. HOOD*

A thoroughly up-to-date chemical laboratory has recently been erected by the United States Metals Refining Co. at its Chrome, New Jersey, plant.

Facilities have been provided for all branches of analytical work, so that the future requirements of the growing plant may be efficiently met.

IN THE custom smelting and refining of ores and bullion, it is essential that proper facilities be provided for prompt and accurate analytical determinations on the samples of the ore and bullion received, as well as for control of the various metallurgical processes. In order that these requirements be met properly, the chemical laboratory must be so arranged that ample facilities are provided for the necessary routine work and that there be room for future expansion, to prevent overcrowding at an early future period.

The Chrome plant of the United States Metals Refining Co. had grown to such an extent that it was desirable to provide more adequate laboratory facilities. Also, owing to the expansion of the plant, the ground upon which the then existing laboratory stood was urgently needed for other work. Early in 1916, it was therefore decided to erect a new laboratory which would handle the plant work at that time and have sufficient capacity for taking care of probable future requirements for many years. No expense was spared in design and construction to secure the most up-to-date and efficient facilities.

The building is a two-story brick structure, 50 by 115½ ft. Brick partitions and concrete floors are used throughout, with an asbestos-covered roof carried on steel trusses, making the structure as fireproof as possible. A basement with a concrete floor is used for storage purposes. All workrooms are piped for gas, hot and cold water, compressed air at 50 lb. pressure, and suction at about 10 lb. The building is heated by steam and lighted by electricity. A telephone system with a switchboard in the laboratory office affords communication among the various rooms in the building. Fig. 3 shows the arrangement of the first and second floors.

All the hoods are of Alberene stone, supported on pipe framework. The hood doors are of ½-in. asbestos board, held in wood frames. The tops of the hoods are connected to an exhaust fan of 30,000 cu.ft. capacity, by means of A. R. M. Co. iron, pitch-lined pipe. All hoods are equipped with gas, compressed air and suction connections. Fig. 5 illustrates their construction. Where required, in place of steam baths, electric stoves are used which maintain a uniform temperature of about 90° Centigrade.

The work benches, Fig. 4, are oak cabinets supported on short legs made of pipe, making a sanitary base, and with Alberene tops, and drawers and lockers as shown. The balance tables, shown in Fig. 2, consist of slabs of reinforced concrete 10 in. thick and three feet wide, supported on white tile piers, and with lengths varying to suit the requirements. This construction has served

*Assistant to the superintendent, Chrome plant, United States Metals Refining Co.

to reduce to negligible amounts all vibration from motors, passing trains, etc., and has proved satisfactory even for the gold balances on the second floor.

The battery department, in which the electrolytic determinations for copper are made, is situated in the five rooms in the northeast corner of the first floor. Women perform all the work in this department, amounting at present to a little over 100 electrolytic determinations per day. The three battery rooms are fitted with steel gratings, protecting the doors and windows, to safeguard the platinum which is left on the shelves overnight during electrolytic deposition. Smoot electrolytic stands are used. The balance room for this department is furnished with two balance tables on white-tiled piers with space for six balances. The wet room has white-tiled walls, three stone-top benches and a hood of Alberene stone. Smoot flasks and automatic pipettes are used for the work in this room. The ladies' rest room is furnished with lockers, desk, table, lounge and easy chairs, and is made attractive in various ways.

The analytical department occupies the south end of the second floor. The main laboratory room is well lighted by windows on three sides and is one and a half stories high, the roof trusses being exposed. The walls are of white tile and all tables are similar to that shown in Fig. 4. The hood is of Alberene stone, as shown in Fig. 5. Thus each man has plenty of table space and room to work in. He is also close enough to the hood to be able to watch the work there. This arrangement of laboratory equipment has proved highly satisfactory from an operating point of view. The hydrogen sulphide and balance rooms are separated from the main room by hallways. This prevents stray H_2S fumes from getting where they are not wanted, and protects the balances against all fumes.

The assay department, consisting of four rooms, is

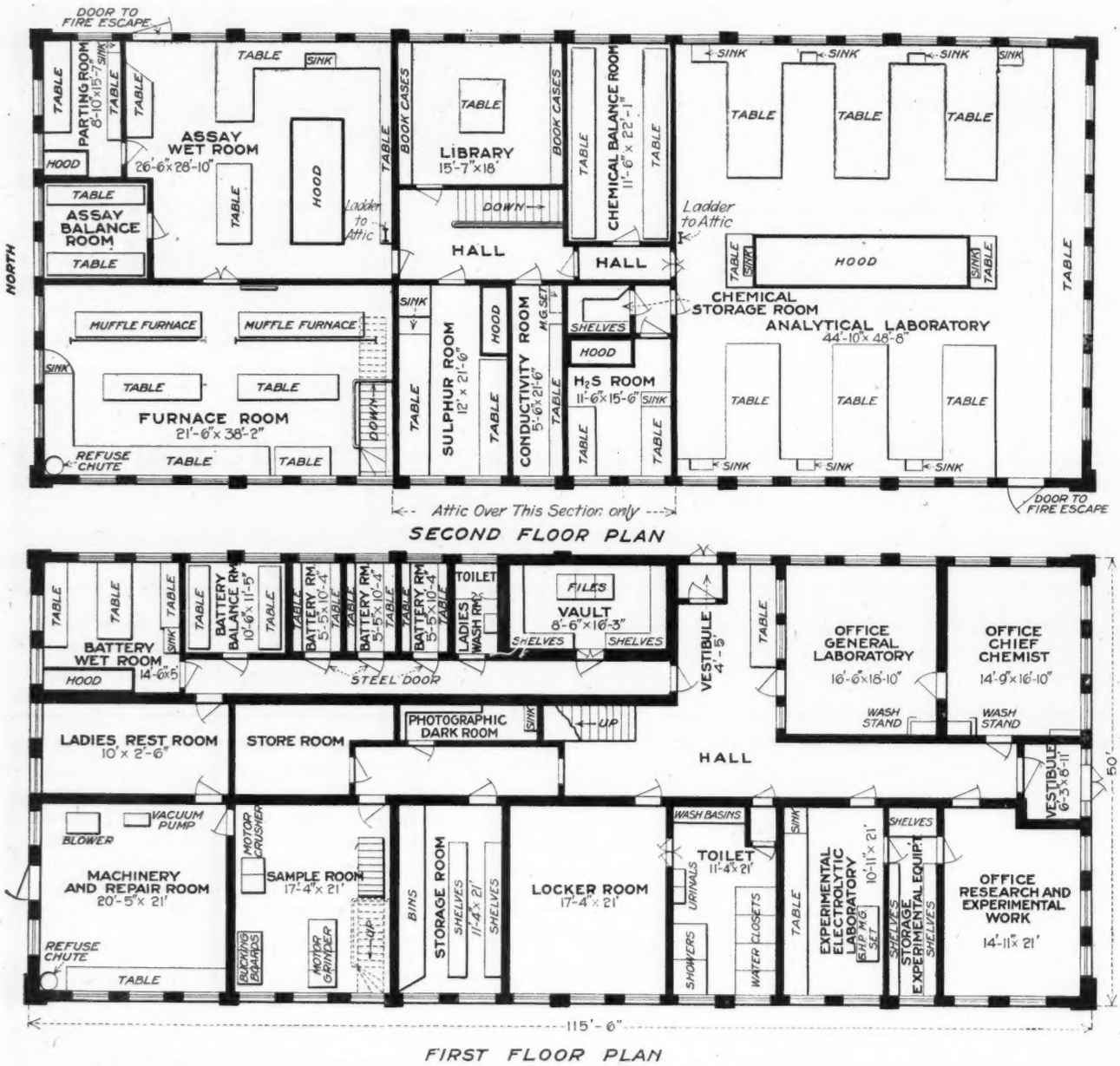


FIG. 3. LAYOUT OF NEW CHEMICAL LABORATORY AT CHROME PLANT OF UNITED STATES METALS REFINING CO.

situated at the north end of the second floor and is of the same height as the analytical department, except the parting and balance rooms, which have ceilings over them. Six oil-fired muffle furnaces equipped with asbestos curtains are used in the furnace room. These curtains protect the operators in front from the heat generated back of the furnace. A frame bearing the operators' names is attached to the assayers' table, as shown on work table in Fig. 4. This system is followed throughout the laboratory, and identifies the men with their positions, and indicates responsibility for local conditions, thus creating a feeling of pride which promotes tidiness. The refuse chute in the corner of the room leads to a box in the basement, making a convenient way of disposing of refuse from the furnace room and workroom below.

The assay wet room has white-tiled walls and stone-top tables and an Alberene stone hood. One reinforced-concrete table with white piers supports the balances used to weigh out assay charges. A steel fire-escape leads from a door in this room to the ground. The balance room for the assay work has two reinforced-concrete tables on white-tiled piers, with space for the six balances. The parting room has walls of white tile and, besides the stone-topped tables and Alberene stone hood, has a sample-shaking machine. It is also fitted with double windows as a protection against dust. About 300 assays per day are made at present.

The central part of the second floor is ceiled, the attic above it containing the ventilating fans for the hoods, etc. In the sulphur room determinations for sulphur are made. This is out of reach of any outside sulphur fumes that would tend to vitiate the determinations. This room is also used for oxygen determinations and special analytical work requiring freedom from interference. In the conductivity room is installed the very latest Hoopes conductivity bridge with a special balance for weighing wire. Special apparatus for annealing the wire is included in the equipment. Tests for electrical conductivity are made twice on wire drawn from furnace charges while those charges are being cast into refined product, thus furnishing a control upon the product intended for wire, etc., while it is being produced.

The plant library, containing about 800 volumes, principally upon metallurgical subjects, is on the second floor and is open to all employees. Current periodicals are kept on file.

At present, the metallurgical department is housed in the building, and, besides other space, occupies the office on the first floor in the southwest corner. It has here among other equipment a complete metallographic outfit, which has proved valuable in the study of refined copper. This work is in charge of W. C. Smith, metallurgist.

The main laboratory offices are conveniently situated on the first floor, and all clerical work in connection with the laboratory is done in them. All offices, halls and workrooms in the building are painted white. The laboratory is in charge of H. D. Greenwood, chief chemist, who has a force of 42 employees.

The analytical work done by this department covers the following: (1) Ores and bullion to be smelted or refined; (2) fluxes, fuel, brick, etc.; (3) byproducts such as slags, cobbings, flue dust, etc.; (4) departmental products as matte, anodes, cathodes, etc.; (5) solutions as electrolytes, acids, etc.; (6) refined products, copper, silver, gold, etc.; and (7) experimental work of a special nature.

Almost all samples come to the laboratory already prepared and put up in 4 x 7-in. manila envelopes. Moisture determinations and sizing tests are made in the sampling department before going to the laboratory. Samples in which persons outside of the company are interested arrive in triplicate; otherwise in duplicate. At a table in the lower hall the samples are each given a serial number, which is written on the envelope; then a triplicate record is made of the sample on a printed form. The original, a white copy, is not perforated and is left bound in the book which is kept in the office. The pink and yellow copies are perforated, and, after being separated, are fastened to the samples. Of the latter that are in duplicate one goes with the pink slip to the analytical or the battery division of the laboratory; the other, with the yellow slip, is taken to the assay division. The third sample of those in triplicate is sent to the vault for the use of the umpire, if that proves necessary.

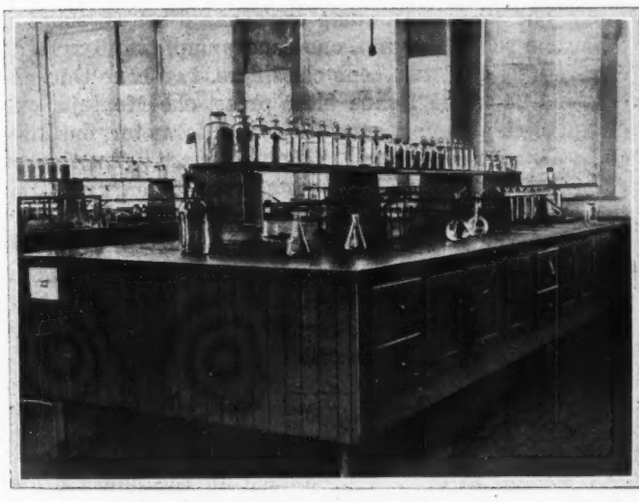


FIG. 4. WORK BENCHES HAVE ALBERENE STONE TOPS AND SANITARY BASES

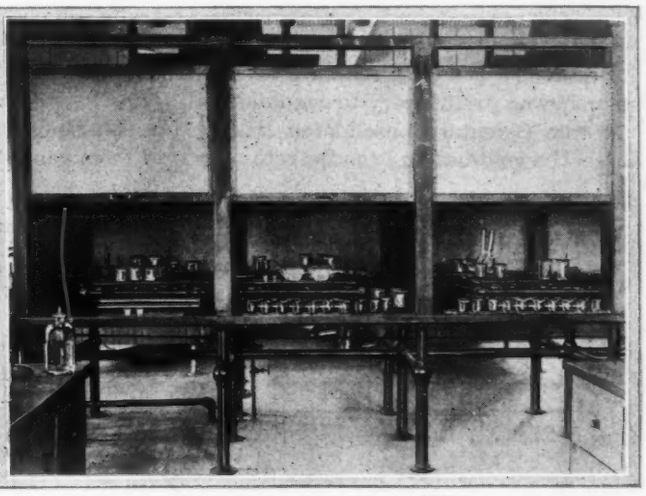


FIG. 5. HOODS ARE BUILT OF ALBERENE STONE WITH PIPE FRAMEWORK

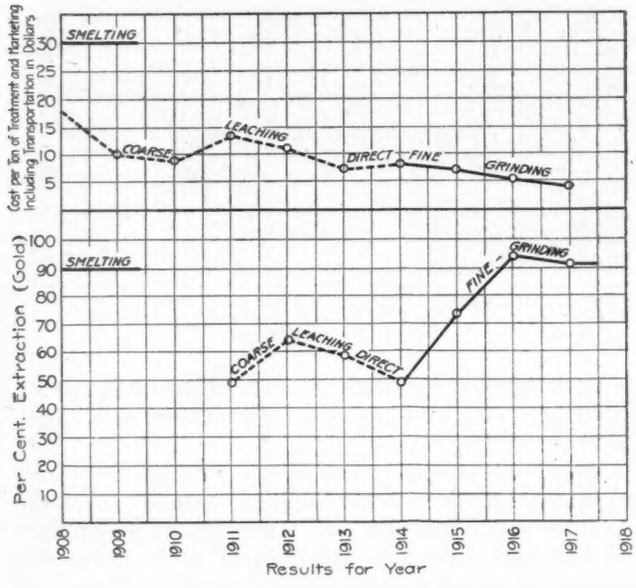
Upon the slips the individual chemist and assayer notes his results, and on the back of the slips does all the computing that is necessary. They are then returned for O.K.ing in the laboratory office, where the results are entered on the white slips for record. The pink and yellow slips are kept in a topical file. An assay certificate is filled out for those samples for which financial accounting is necessary. A certificate of a different form is made out for all other samples. The original certificate in each case is initialed by the chief chemist or his assistant and the carbon copies are punched with his initials.

Cyaniding Concentrates vs. Smelting

BY A. E. DRUCKER*

The importance of cyaniding raw gold-bearing concentrates on the spot is clearly demonstrated by the following results, vs. shipping and smelting. It is also proved that fine grinding in cyanide solution to pass a 200-mesh screen is absolutely necessary for a high extraction (90 to 95%) of the gold within a reasonable length of time (24 to 48 hr.). In most cases preliminary roasting is unnecessary. At Kalgoorlie, Australia, which is an exceptional case, presence of gold telluride necessitates almost complete roasting (0.11 to 0.35% S) and fine grinding preliminary to cyanidation.

At the Oriental Consolidated Mining Co., Maibong, Korea, the gold-bearing concentrates obtained from van-



ners were originally shipped to a smeltery in America for treatment. The total cost for marketing was about $30 per ton, which included handling, transportation, smelting, and refining. In addition, there were the usual deductions at the smeltery for moisture, fines, and extraction, which, if accounted for, would put the marketing cost considerably above $30. The approximate analysis of the concentrates was as follows: SiO_2, 63%; pyrites, 18%; arsenical pyrites, 17%; iron oxide, 2%; zinc and lead, traces; total, 100%. These concentrates were finally refused at the smeltry owing to the high arsenic content.

During 1908-'09-'10, this sulphide material was transported to Taracol (24 miles) and treated 18 days by percolation direct at the Taracol cyanide plant at a total average yearly cost of $18.13, $10.27, and $9.09 per ton respectively. The extraction was not satisfactory. During 1911-'12-'13-'14, it was taken (20 miles) to the company's cyanide plant at Kuk San Dong and treated 16 to 20 days by percolation, at a total average yearly expense per ton of $13.68, $11.38, $7.50, and $8.36. The extraction of the gold for these periods was 49.1, 64.7, 58.8, and 49.0% respectively. These results were also far from satisfactory. Finally during 1915-'16-'17, the following method was employed successfully: The raw concentrates were treated on the spot by fine grinding in a cyanide solution, air agitation, decantation, and filter-pressing, at a total cost per ton of $7.38, $5.59, and $4.47. The extraction of the gold for the corresponding periods was 73.9, 94.2, and 91.2%. This result has been highly satisfactory in comparison with former methods and smelting.

This plant, which began operations on Jan. 16, 1915, is housed in a wooden frame building 35 ft. by 81 ft. and contains one 3 x 12-ft. tube mill, two 8 x 23-ft. agitating tanks, one 12 x 15-ft. sump tank, one 6 x 8-ft. solution tank, one solution pump, one sand pump, two 6 x 10-ft. clarifying tanks, two cone classifiers, two cone thickeners, one 24-frame Dehne filter press, one Monteju, one 48-hp. electric motor, one 25-hp. electric motor, one 150-cu.ft. air compressor, and three zinc boxes. The figures given on extractions and costs were taken from the company's annual reports.

There are many sulphide gold ores that are amenable to flotation methods, and there will be an increasing amount of concentrates produced in the future which will require cyanide treatment on the spot for the recovery of the precious metals.

*Consulting Engineer, 50 Church St., New York.

Ramsay Memorial Fund

A committee of men prominent in the physical and chemical sciences in Great Britain was organized after the death of Sir William Ramsay in July, 1916, for the purpose of raising a substantial fund to be used for the establishment of Ramsay research fellowships, tenable wherever necessary facilities might be available, and a Ramsay memorial laboratory of engineering chemistry at the University of London, where Ramsay served 26 of his most fruitful years of activity.

Through this general organization, committees were formed in many countries, including the United States. The sum to be raised was set originally at £100,000, of which more than £300 has been contributed by residents of this country. The committee in the United States is headed by Walter Hines Page, as vice president, and Charles Baskerville, chairman. Many well-known men are on the committee. Contributions in the United States may be sent to the Ramsay Memorial Fund Asscciation, 50 E. 41st St., New York.

Aluminum Co. of America, through its welfare department, has created plant facilities at Massena, N. Y., for instruction in English and preparation for naturalization. It is also distributing in pay envelopes a series of 12 civic-lesson leaflets in English and foreign languages.

Ore Deposits of the Yellow Pine Mining District of Nevada*

BY FRED A. HALE, JR.†

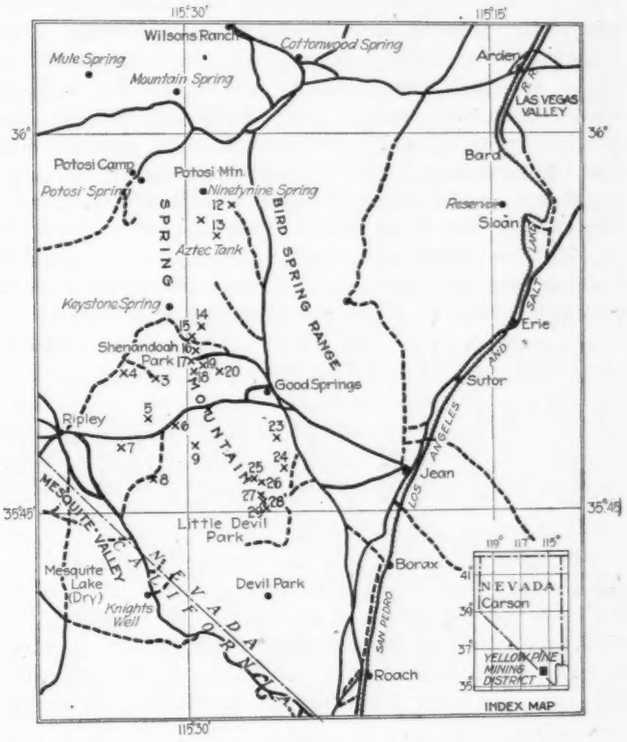
The Yellow Pine Mining district, in the southwestern part of Clark County, Nevada, was known for many years, but did not attract important attention until 1906, when oxidized zinc ores were discovered. The construction of the Los Angeles & Salt Lake R.R. at the same time gave the district transportation facilities, and a rapid development has since taken place. Zinc, lead, copper, and gold ores are produced. At the Boss mine, platinum and palladium in association with copper ores have been discovered. The district is now making an important annual production.

THE paper here presented is intended only as a description of the most prominent geologic features of the Yellow Pine district, with special reference to those of economic importance. The first mention of the district was in 1903 by J. E. Spurr,[1] who briefly described the structural geology of the Spring Mountain range. In 1906, H. F. Bain[2] briefly described the Potosi mine. James J. Hill,[3] of the United States Geological Survey, visited the district for a short period in 1912, the result of which is an excellent reconnaissance report, covering the district in some detail, but necessarily with brevity. Since that time, articles covering special features of the district have appeared in the technical press, including some by the author of this paper, and a description of the Boss mine, by Adolph Knopf,[4] appeared in 1915. Development of the district during the last few years has progressed so rapidly and with so many notable discoveries, particularly with reference to the rare metals, that a further description at this time should prove of interest.

YELLOW PINE DISTRICT OF 400 SQUARE MILES AREA

The Yellow Pine mining district is situated in the southwestern part of Clark County, Nevada, about 300 miles northeast of Los Angeles, along the line of the Los Angeles & Salt Lake R.R. The district extends from Mount Olcott on the north to the California line on the south, with a width of about 16 miles east and west, the total comprising an area of 400 sq.mi. The principal shipping point is Jean, Nev., on the Los Angeles & Salt Lake R.R., although considerable ore is also shipped from Arden and Roach, situated on the same railroad. A narrow-gage railroad, owned and operated by the Yellow Pine mining company, but used exclusively for ore haulage, connects Jean with Goodsprings, eight miles west of the railroad, and thence proceeds to the Yellow Pine mine, four miles further west. Goodsprings is situated at about the center of the district, and is the main supply point. Wagon roads connecting the various properties with the railroad are uniformly good during all seasons. The Yellow Pine district embraces the south end of the Spring Mountain range, an extremely irregular group of mountains composed largely of sedimentaries. The range is separated from the Kingston Mountains on the west by the Mesquite Valley, with Ivanpah Valley immediately east of the range. These are broad, flat valleys, greatly accentuating the rugged character of the adjacent mountains.

The general trend of the Spring Mountain range is northeast and southwest, the highest point being Mount Olcott on the north, having an elevation of 8500 ft., with Diablo Grande on the extreme south, with an elevation of 5865 ft. Water is not abundant in the district, but a few natural springs occur on the slopes of Mount Olcott and an abundant water supply has been developed at Goodsprings by wells of shallow depth. Water has also been developed in considerable quantity at various points in the Mesquite Valley. An equable climate makes operation possible throughout the district at all times of the year.



Potosi
3. Keystone
4. Aura Amigo
5. Whale
6. Bill Nye
12. Ninety-nine
16. Prairie Flower
17. Yellow Pine
20. Lavinia
25 Porter
26. Monte Cristo
27. Accident

SKETCH MAP—YELLOW PINE MINING DISTRICT

The oldest mine in the district, and one of the first locations in Nevada, is the Potosi, on the west slope of Mount Olcott, adjacent to the old Mormon trail which connected Salt Lake City with San Bernardino. Owing to the inaccessibility of the district, it attracted little

*A paper read before the New York meeting of the A. I. M. E., February, 1918.

†General manager, Yellow Pine Mining Co., Good Springs.

[1]Geology of Nevada South of the Fortieth Parallel, Bulletin 208, U. S. G. S.

[2]Bulletin 285, U. S. G. S.

[3]Bulletin 540F, U. S. G. S.

[4]Bulletin 620A, U. S. G. E.

attention until after the discovery of gold at the Keystone mine in the early 90's. The Keystone mine, situated on the west slope of the range, produced some very rich gold ore, and is credited with a production of over $1,000,000, most of which was milled at a small plant erected at Sandy, in the Mesquite Valley. The discovery of this mine stimulated prospecting in the district, with the result that many locations on outcrops of copper, lead, and silver were made. It was not until 1906 that the presence of zinc was recognized in the ore, and the advent of the Los Angeles & Salt Lake R.R. about that date resulted in increased shipments.

Lead-Zinc Oxidized Ores Complex

However, the complex nature of the mixed lead-zinc oxidized ores presented many difficulties, and first results from the smelters were somewhat disappointing to the shippers. After considerable experimenting, in 1910 the Yellow Pine Mining Co. evolved a process for separating the lead and zinc minerals in their ores to produce readily marketable products, with the result that a 100-ton plant was erected at Goodsprings and has been operated successfully since that date. The Yellow Pine narrow-gage railroad was constructed in 1911. During recent years, several smaller milling plants have been erected, most of them of the dry-concentration type, and production of the district has steadily increased. An important development of recent years was the discovery in 1914 of platinum metals in the ores of the Boss mine. This discovery attracted considerable attention to the district, and some valuable development has been accomplished; the production of platinum promises to become of prime importance.

The production of the Yellow Pine mining district, up to and including 1915, is as follows:[5]

Year	Gold	Silver, Oz.	Copper, Lb.	Lead, Lb.	Zinc, Lb.	Total Value
To 1912	$196,515	101,779	521,411	5,138,247	15,834,643	$1,453,715
1912	34	223,013	103,398	6,544,917	13,254,860	1,363,354
1913	1,268	192,339	283,592	6,204,065	14,369,709	1,239,081
1914	8,034	122,703	156,389	4,185,208	11,862,149	864,882
1915	833	100,146	262,600	4,620,243	21,061,182	2,926,300
Total..	$206,684	739,980	1,327,390	26,692,680	76,382,543	$7,847,332

The figures include only the production reported to the United States Geological Survey and necessarily do not embrace the entire production of the district; the gold production of the Keystone mine is, for example, absent. Production figures for 1916 are not yet available, but will show a substantial increase in all metals over 1915.

Areal Geology of Yellow Pine District

The Spring Mountain range consists largely of sedimentary rocks of Paleozoic age, estimated by Spurr to have a total thickness of approximately 17,000 ft. Of this section, about 2000 ft. is Cambrian quartzite, exposed at the extreme north end of the range, the remainder being limestone of Cambrian and Carboniferous age. Devonian limestone may also be present in the series, but, if so, it has never been definitely identified. At the north end of the range, the east flank is composed of a series of 1500 ft. of yellowish and reddish sandstone of Mesozoic age, correlative to the Triassic and Jurassic of the Grand Canyon series. Flanking the range to the south is a series of Quaternary gravels more or less consolidated.

[5]Taken from *Mineral Resources* of the United States.

From an economic standpoint, the important part of the section is a series of Carboniferous sedimentaries, about 3000 ft. in thickness, comprising the main portion of the southern limb of the Spring Mountains, as it is in this series that all known orebodies in the Yellow Pine district have occurred. The series is composed mainly of limestone, varying in appearance from light-colored thinly bedded strata, to massive, dark thick-bedded limestone. Most of the limestone is somewhat siliceous, although occasional strata are composed of a pure crystalline variety, and dolomitic varieties are not infrequent. The limestone beds are occasionally interspersed with strata of a grayish fine-grained sandstone, important only on account of their relation to known orebodies, and beds of calcareous shale are also evident.

Igneous rocks are not plentiful in the Yellow Pine district, but are important on account of their relation to known orebodies. The intrusive rocks consist largely of dikes and sills of monzonite-porphyry, varying in color from pink to yellowish brown. The most prominent intrusions consist of three large dikes of monzonite striking nearly north and south roughly parallel and with several hundred feet of sedimentaries intervening. These dykes are known respectively as the Lavina, Yellow Pine, and Keystone porphyries, and outcrop at various points in the district, indicating a thickness of from 100 to 400 ft. The rock composing the dikes varies greatly in texture, but in all cases is distinctly porphyritic, showing phenocrysts of quartz, orthoclase, plagioclase, biotite and augite, in a fine-grained groundmass. Some sections of the poryhyry indicate considerable alteration, such minerals as limonite, chlorite, and sericite being present, but the sedimentaries in contact with the intrusions show little alteration.

Small Dikes Numerous

In addition to the three larger intrusions are numerous smaller dikes, usually striking about N 30° W and varying in thickness from 10 to 20 ft. The rock of these dikes is a monzonite-porphyry, similar to that already described, except that it appears to be slightly more acid, and the dikes frequently occur associated with the larger intrusions. It is possible in some cases that the smaller dikes are offshoots from the large intrusion, although I am of the opinion that they are due to a phase of minor intrusion following the original intrusive period. The age of these intrusions has not yet been definitely established, but it is undoubtedly post-Jurassic and probably Tertiary. The only occurrence of extrusive rock in the district is a horizontal sheet of biotite-andesite, about 20 ft. thick, capping what is known as Table Mountain, in the southern part of the district. It is evidently of volcanic origin and has no relation to ore deposits.

The Spring Mountain range throughout shows intense and complex folding, accompanied by numerous faults and fissures. According to Spurr, the general structure of the range is a broad syncline with numerous minor folds. Across the north-south section the structure is anticlinal. However, in the Yellow Pine mining district, the sedimentary beds have a persistent dip westerly or southwesterly at angles of 15 to 45° and may be considered monoclinal. In this vicinity of Porphyry Gulch, in which is the Yellow Pine mine, is a local dome-shaped anticline, with a central axis about at the apex of Ruth

Mountain. The northern limb of this anticline has been removed by erosion, but the southern limb includes the ore zones of the Yellow Pine, Yellow Pine Extension and Prairie Flower mines. At the Yellow Pine Extension, on the south, the beds dip southerly, westerly at the Yellow Pine, and northwesterly at the Prairie Flower, the strike of the beds assuming roughly the arc of a circle. Other local folds occur at various points in the district, notably in Devil Canyon, near the south end of the district, where intense local folding is evident.

Of the faults observed in the district, by far the most profound is the Great Fault along the eastern slope of the Spring Mountain range. This is evidently one of the main continental faults, striking nearly north and dipping steeply in an easterly direction. The throw of the fault is evidently at least 3000 ft., the eastern block being down-thrown this distance, as evidenced on the eastern slope of Potosi Mountain, where the Mesozoic sandstone is against the Mississippian limestone. This fault may be readily traced throughout the length of the district, a distance of 25 miles. Two other important series of faults occur in the district; a series striking about N 30° W, dipping 75° northeasterly, and a series striking north and south, parallel with the Great Fault, but with minor throws. One or both of these series of faults are invariably associated with the orebodies and on this account are of special importance.

Ore Deposits Oxidized Lead-Zinc and Copper-Gold

The principal ore deposits of the Yellow Pine district may be divided into two general classes, oxidized lead-zinc deposits, and copper-gold deposits; some of the latter also contain an important proportion of platinum metals. Of the two classes, by far the greater tonnage has been derived from the lead-zinc deposits, although of late years the copper-gold deposits have assumed considerable importance. Silver in varying quantities is contained in ores of both classes and is an important constituent of nearly every deposit.

Ore deposits of this class occur in three distinct stratigraphic zones throughout the district, nearly every orebody having certain characteristics from which its zone may be determined. (1) Lower zone, including the Potosi, Snowstorm, Contact(?), Pilgrim, Prairie Flower, Yellow Pine and Yellow Pine Extension, with possibly the Monte Cristo orebodies. (2) Middle zone, including the Mobile, Whale, Lookout, Mountain Top, Palace, Porter, Accident, Bullion, Anchor and Valentine orebodies. (3) Upper zone, including the Bill Nye, Akron, Surprise, Dividend, Volcano, Christmas and New Year orebodies.

Such properties as the Green Monster, Milford, Addison and Tam O'Shanter have not been included in the classification, as their distance from other deposits makes correlation difficult without a careful study of the individual property. However, it is possible that they may be included in one of the known zones.

The distances between the various zones have not been computed accurately, but amount to several hundred feet, the greater distance being between the lower and middle zones, and all zones being included in the Upper Mississippian limestone series. Of the lower zone, which to date has been the most productive in the district, the Yellow Pine mine in Porphyry Gulch may be taken as the best example, this property having a larger record of production than any in the district, and the nature of the deposit being typical of the oxidized lead-zinc orebodies in the vicinity. The deposit at the Yellow Pine mine occurs adjacent to, but not in contact with, a large intrusion of monzonite-porphyry, previously mentioned as the Yellow Pine porphyry. The intrusion in the vicinity of the Yellow Pine takes the form of a sill, the contacts being conformable with the limestone strata, which dip about 35° westerly.

For exploration purposes, the index strata are considered to be a calcareous sandstone in the hanging wall and the thick-bedded shale in the footwall of the so-called "ore zone." These beds are evident in all deposits of the lower zone, except where they have been removed by erosion, as is the case at the Potosi mine, where the sandstone is absent. In the Yellow Pine mine, the orebodies frequently extend to one or the other of these index strata, although more often there are beds of intervening limestone, and in no case does the ore extend into or beyond either the sandstone or the shale.

Orebodies Confined to One Limestone Stratum

The orebodies of the Yellow Pine mine are essentially of the replacement type, and are apparently confined to one limestone stratum, although frequent step-faulting with considerable throw gives the appearance of separate orebodies. The step-faults are of N 30° W series, with the southern block invariably thrown northwesterly, and have evidently been the means of egress for the mineral-bearing solutions which formed the replacement deposits. In fact, the large continuous orebodies which are found in the Yellow Pine mine are apparently due to the frequent occurrence of faults of this nature, it being apparent that the mineral-bearing solutions were incapable of replacing the limestone more than a few feet from a zone of fracture. Most of the northwest faults are mineral-bearing in the nature of a fissure filling, and much valuable ore has been derived from this source, although the greater quantity by far has come from the replacement beds.

The ores of the Yellow Pine mine consist of a mixture of smithsonite and calamine, with cerussite and occasional galena, the lead minerals carrying silver values to the extent of about 0.5 oz. to the per cent. of lead. Hydrozinkite in irregular masses and cave-fillings is commonly found in the orebody, and anglesite is a not infrequent mineral. The ore is commonly of brownish or pinkish color, due to the presence of small quantities of iron, cobalt, and manganese, and varies in texture from earthy masses to dense hard chert-like varieties. The lead and zinc minerals are intimately mixed as a rule, although considerable zinc ore, free from lead, has been produced, and some high-grade lead ore comparatively free from zinc. A general average of the metal content of all ores extracted to date (approximately 100,000 tons) would be about 30% zinc, 14% lead, and 9 oz. silver per ton. There are no true gangue minerals in the Yellow Pine deposit, the entire limestone stratum having been replaced by the lead and zinc minerals in most cases, except for occasional thin ribs of siliceous limestone, frequently altered to chert. Small masses of soft limonite, calc-spar and gypsum have also been noted, these being the result of alteration of the original orebody.

The orebodies of the Bybee mine have been of remark-

ably large size, considering the high metal content of the ore. At a depth of 100 ft., the length of the main orebody was 360 ft., with an average width of 40 ft. This was followed continuously to a depth of 500 ft., the limits being more or less irregular. Both north and south the ore was cut off by northwest faults, but at a depth below the 500-ft. level a southern extension of the orebody was discovered and has been stoped 300 ft. south and 200 ft. in depth, with limits as yet undetermined. Similarly, a northern extension of the orebody has recently been developed nearly to a depth of 700 ft. The width of the orebody remains fairly uniform throughout both north and south extensions.

The orebody at depth appears to be as thoroughly oxidized as close to the surface, no sulphide of zinc having been found and no increase in the amount of lead sulphide. This is undoubtedly due to the intense faulting and fracturing throughout the orebody, allowing free access of oxidizing agents to considerable depths. No ground-water level has yet been reached.

Of other properties classified as in the lower zone, the Potosi mine, situated in the north end of the district, is of next importance, having produced approximately 60,000 tons of oxidized ore during the past few years. The ore is similar in character to that of the Yellow Pine, except that the lead content is markedly less and practically all the shipments have been of crude zinc ore. Ore deposits in the Yellow Pine Extension and Prairie Flower, other properties in the lower zone, are similar in character to those of the Yellow Pine, although somewhat smaller, and the Pilgrim and Snowstorm properties show similar characteristics.

Deposits of Middle Zone in Crystalline Limestone

The ore deposits classified as in the middle zone all occur in a buff-gray crystalline limestone stratum which strikes nearly north and south and dips westerly at angles from 15° to 45°. This stratum may be traced continuously throughout the district, although it is frequently displaced by faults. A bed of heavy blue limestone immediately overlies the ore-bearing limestone of the middle zone, and forms a distinctive stratum from which the various orebodies may be correlated. The orebodies are by no means continuous throughout the length of the bed, a distance of about eight miles, but seem to be entirely dependent upon local faulting and fissuring at various points along its extent. Igneous intrusions have apparently not been of so much importance to ore deposition in this zone, although the relation of igneous activity to the deposition has not been clearly demonstrated.

The ore found in this zone is somewhat similar to that of the lower zone in that the principal constituents are minerals of lead, zinc and silver. However, the ore generally is not so thoroughly oxidized and presents some distinctive characteristics. The lead occurs mostly as galena, occasionally coated with anglesite and showing some cerussite. Silver content usually averages about 0.25 oz. to the per cent. of lead. Zinc occurs almost entirely in the form of carbonate, varying from a soft pinkish variety to hard crystalline smithsonite. Sphalerite has also been noted in several instances, encased by hard smithsonite. Gangue minerals are much more frequent than in the lower zone, a crystalline calc-spar being characteristic of the zone. Large masses of soft limonite and granular quartz are sometimes present. Of the properties in the middle zone, the Anchor, situated in the southeastern portion of the district, has had the largest production and is a typical deposit. The property has now been developed to a depth of about 400 ft., showing frequent oreshoots averaging about four feet thick and of varying lateral extent up to 100 ft., the length evidently being governed by the distance from fault fissures.

The so-called upper zone is less developed than either of the lower zones, but in recent years has become of considerable importance, and is found in the Bill Nye, Surprise, Dividend and Christmas properties. The ore at all of these properties presents a more siliceous facies than either of the other two zones, the ore occurring adjacent to and occasionally included in a bed of grayish fine-grained sandstone. The underlying stratum is a soft crystalline limestone, also ore-bearing, and the footwall is a heavy blue dolomitic limestone. As in the lower zones, fissuring seems to have played an important part in the ore deposition, and both the northwest and north-south fracturing is quite prominent. In the ore lead occurs largely as galena, showing marked flow-structure, the cubic variety not occurring in large quantities. The silver content is considerably higher than in either of the other zones, averaging about 0.75 oz. to the per cent. of lead and frequently much higher. Zinc occurs largely as calamine, but smithsonite and hydrozinkite are usually present.

Character of the District's Copper-Gold Deposits

The copper-gold deposits are found in various places in the Yellow Pine district, apparently without any stratigraphic relation to the zinc-lead deposits. They are usually clearly distinct from the lead-zinc orebodies, but, similarly, they are apparently determined by the presence of fracture zones, usually of the northwest series. It is also significant that they are usually found in the vicinity of intrusives; in fact, at the Lavina mine a large monzonite-porphyry intrusion contains pyrite and chalcopyrite in considerable quantity, clearly indicating that the intrusives have been the source of the copper ore in the vicinity. The Lavina intrusive contains the only primary ore yet discovered in the district, other orebodies consisting largely of minerals typical of the zone of oxidation: cuprite, malachite, azurite and chrysocolla, with occasional chalcocite.

At the Ninety-Nine, Copper Peak and Columbia properties, all of which have records of substantial copper production, the ore occurs in a buff-colored crystalline limestone, in masses roughly conformable with the strata and averaging a few feet in thickness. Minerals of the orebodies are all of the secondary type, cuprite and malachite predominating, with occasional chrysocolla and chalcocite. Apparently, the orebodies are all of the replacement type, with lateral extent limited by the distance from fractures. Replacement of the limestone beds has not been complete in most cases, the common gangue minerals in the ore being a pinkish calcite and soft limonite. The orebodies in these properties are not definitely associated with igneous intrusions, but the fact that they occur in a belt of igneous activity seems to indicate that further development will disclose their relation to igneous rocks. At the Lincoln property, in the eastern portion of the district, ore of similar char-

acter occurs in limestone adjacent to a large intrusion of monzonite-porphyry. This deposit is of special interest in that the oxidized ore is associated with cerargyrite (horn silver) which occurs in considerable quantity in the cleavage planes of the ore, which is a mixture of cuprite and malachite. Gold is also present.

The central western portion of the district has assumed considerable importance of late years on account of the discovery of platinum metals associated with the copper ores in this vicinity. Of the orebodies so far discovered, the largest and most important is that at the Boss mine. The ore occurs in a series of dolomitic limestones, part of the Upper Mississippian series, striking northeast and dipping about 15° west. All orebodies so far developed occur in a zone of fracture, striking north and averaging about 30 ft. in width. About 500 ft. north of the deposit is a large intrusion of monzonite-porphyry, probably an extension of the Keystone porphyry. Some development work on the contacts of this porphyry has shown low gold content, but generally it appears unmineralized.

The Boss mine has been opened by a series of four adits, following the fractured zone at various elevations. All of these expose oreshoots, the largest opened to date being between the first and second levels, where an ore zone averaging about 12 ft. thick and 150 ft. long has been disclosed. Two types of ore occur in this orebody, a light-gray quartzose material that crumbles to a fine sand, which contains platinum and gold almost entirely free from copper, and a copper ore, containing malachite, chrysocolla, and cuprite, occasionally associated with limonite. The oxidized copper ore usually contains very little platinum or palladium when free from the quartzose material.

Gold and Platinum Occur in a Free State

Associated with the quartzose material in the form of irregular masses and small veinlets is a greenish talcose substance which has been identified as a bismuthic variety of plumbo-jarosite, a basic lead ferric sulphate. A careful study of this mineral has demonstrated that it contains the gold and platinum in the Boss ore to a very large extent. Apparently, however, neither the gold or platinum is in combination chemically with this mineral, but occurs in a free state intimately associated with it. Only rarely can a grain of the platinum metals be panned, as it is evidently so finely divided as to resist mechanical concentration. Analyses of the gold, however, have demonstrated that the gold and platinum occur separately and not as an alloy, nor have any minerals of platinum other than the native metal been identified.

The metals of the platinum group that are found in this ore are platinum, palladium and iridium, with traces of rhodium. Only platinum and palladium occur in sufficient quantity to be of commercial value, and the two are found in apparently no fixed ratio. Generally, however, palladium exceeds the platinum content, although a sample of a small shipment of high-grade ore, made in 1914, assayed 111 oz. gold, 99 oz. platinum and 16 oz. palladium to the ton. Other samples of the plumbo-jarosite have assayed approximately 500 oz. gold and 260 oz. platinum metals per ton, the platinum metals containing palladium in excess of platinum. According to Knopf, a composite of 22 samples taken in the orebody, and including the quartzose gangue matter with streaks of plumbo-jarosite, assayed 3.46 oz. gold, 6.4 oz. silver, 0.7 oz. platinum and 3.38 oz. palladium per ton, which may be considered as an average of the high-grade siliceous ore in the mine.

The copper ore is usually quite distinct from the siliceous material, occurring as a casing and immediately underlying the siliceous deposits, also as veins two to four feet thick following fractures, and as irregular cave-fillings on the footwall of the fractured zone. This ore contains gold and platinum metals only in limited quantities, the pure cuprite and malachite containing practically no precious metal. However, immediately underlying the large body of siliceous ore is a deposit averaging some 12 ft. thick, composed almost entirely of chalcocite in a fine-grained siliceous gangue of unusual hardness. Average samples of this ore indicate a content of about 15% copper, 0.8 oz. gold and 0.5 oz. platinum per ton. No primary ore has as yet been encountered in the mine, although development work is being done at depth. Large bodies of thoroughly leached zones showing much limonite with occasional veinlets of copper carbonate, disclosed on the upper levels, seem to indicate that a further zone of secondary enrichment may be expected with further depth.

Summary

The development of the properties in the Yellow Pine mining district to date has been comparatively meager. With the exception of the Yellow Pine mines, Potosi and Boss mines, development has been confined entirely to the surface zone, and in no case has groundwater level been reached or the character of the primary ore definitely established. Owing to its inaccessibility, and the complex nature of its ores, the district has been handicapped by lack of capital to develop the various properties, and it is only in recent years that active and intelligent development has been in progress. Railroad and motor trucking have simplified transportation problems.

The successful treatment of the mixed lead-zinc ore by various processes has been demonstrated. The method employed by the Yellow Pine Mining Co. is a specialized application of ordinary gravity concentration methods, using rolls, jigs and concentrating tables. Final concentration of the lead is effected by careful classification and table work, using specially designed equipment. The plant is essentially a separating plant, the process being to remove the lead minerals, the remainder of the ore, or what would ordinarily be known as tailing, being shipped as a zinc product. In 1916, the Yellow Pine Mining Co. milled 20,580 tons of ore averaging 10.5% lead, 30.4% zinc and 4.6 oz. silver, from which was produced 2294 tons of lead concentrate, averaging 54.2% lead, 13.2% zinc and 20.2 oz. silver per ton; 14,240 tons of zinc concentrate averaging 4.4% lead, 32.2% zinc and 2.2 oz. silver; and 3525 tons of zinc slime, averaging 6.5% lead, 33.9% zinc and 3.6 oz. silver per ton.

The scarcity of water in the vicinity has produced a type of dry concentrator which is giving satisfaction, and there are now five plants of this type operating in the district, each having a capacity of about 50 tons per 24 hours. Dry concentrators of both the Stebbins

and the Sutton, Steele & Steele type are used; the best results are produced in the separation of low-grade lead ores from calcite gangue, although the concentrators also effect a fair separation of the lead and zinc minerals. At the Potosi mine, a calcining plant similar to the ordinary lime kiln is in use for treatment of the pure zinc carbonate ores. Oil is used as fuel, and carbonate ore averaging about 34% zinc is raised to an average of over 40% zinc, with a shrinkage in weight of approximately 25%, thus materially reducing freight charges and obtaining a premium for the higher-grade ores. This process has been found to be applicable only to pure carbonate ores, as the mixed silicate ores do not give good results. A problem of the district which still remains unsolved is the treatment of the lower-grade zinc and mixed lead-zinc ores. Owing to the low gravity of the oxidized zinc minerals, no gravity process for separating them from the limestone gangue is applicable. Recent experiments in both leaching and oil flotation have given encouraging results, and it is expected that the successful treatment of this class of ore will be a development of the near future.

Platinum-Bearing Ores Treated at Los Angeles

The complex nature of the platinum-bearing ores of the Boss mine has presented many difficulties, but after extensive experimenting, a process has been evolved which bids fair to prove entirely successful in the extraction of the various metals. Owing to the inaccessibility of the mine and the high cost of labor and reagents, it was decided to erect the plant at Los Angeles rather than at the mine. In consequence, a separate corporation, known as the Palau Metals Co. was formed, and this company, headed by C. A. Overmire, of Los Angeles, the inventor of the process, entered into a contract with the Boss Gold Mining Co. for the exclusive treatment of its platinum-bearing ores. A plant of 300-tons monthly capacity was erected in Los Angeles and has been in successful operation for some time. The details of the process employed are not divulged by the inventors. The ore treated in the plant averages about 7% copper, 4% bismuth, 1.0 oz. platinum metals (platinum and palladium), 0.75 oz. gold and 3.0 oz. silver per ton.

The Ninth Annual Convention of the Northwest Mining Association

The ninth annual convention of the Northwest Mining Association was held in Spokane during the week beginning Feb. 11. From 200 to 300 members attended the sessions, and much interest was manifested in the papers read and discussions that followed. This association is unique in that it embraces a field that combines not only political, technical and business but also social purposes in its aims. The membership of the association is composed mainly of the mining men of the districts tributary to Spokane, and they responded in kind, from the old-time prospector to the mine manager of a property employing a thousand men or more.

As has been the case with practically every convention held since April much of the time was devoted to war matters and patriotic speeches; and as 50 to 60 mining men attended the meeting from British Columbia, the convention was given over, to a large extent, to cementing that feeling of brotherhood and commonness of purpose that the war has created. The association voted this year to affiliate with the American Mining Congress.

A notable event of the meeting was the adoption of a resolution proposing Federal regulation of custom smelteries rates and royalties on patented metallurgical processes, by the Interstate Commerce Commission or other similarly capable body empowered to ascertain costs of smelting and establish scales of charges in conformity therewith and to fix reasonable rates of royalty on the use of all patented processes or devices essential to the proper development of the mining industry.

Dr. E. H. Lindley, president of the University of Idaho, gave an interesting talk on "Human Engineering" in which he discussed the handling of labor. Dr. Lindley, who was formerly professor of philosophy and psychology at the University of Indiana, has given years of study to this subject, and was one of the main investigators engaged by Henry Ford to help him in developing the high state of efficiency for which the Ford plant is so favorably known. Stanly A. Easton, president of the Idaho Mining Association and manager of the Bunker Hill and Sullivan company, outlined the scope and accomplishment of the association, which now has about 1000 members. Mr. Easton called attention to the fact that of the 1200 men employed by his company 70% are native-born Americans, while less than 1% of the foreign born do not have final naturalization papers; that, of the men employed by his company, 62% are married, and of these married men 70% own their own homes. He stated that the Bunker Hill and Sullivan had mined 500,000 tons of ore in 1917 and had produced 100,000,000 lb. of lead and 1,736,000 oz. of silver, and that since its discovery in 1886 the property had produced 7,876,000 tons of ore that brought to the company $80,000,000, of which $20,000,000 went to the stockholders as dividends and the difference was paid out mainly as wages or for supplies in the immediate vicinity, and so had contributed greatly toward the upbuilding of the neighboring parts of Idaho and Washington.

Among the mining men attending the session were Charles M. Campbell of the Granby Consolidated company; W. E. Zwickey of Kaslo, B. C.; W. M. Archibald of the Consolidated Mining and Smelting Co. of Canada, Ltd.; Alfred McMillan of Rossland; Ernest Levy of the Le Roi No. 2 Mining Co.; A. Klockman of the Idaho Continental Mining Co.; Rush J. White of Butte; Frederic Keffer of Spokane; James F. McCarthy of the Hecla Mining Co.; Eugene Day, Harry Day and Jerome Day of the Hercules Mining Co.; W. T. Ziegler and Frank Skeels of the Success Mining Co.; Stanly A. Easton and Michael Sullivan of the Bunker Hill and Sullivan; George S. Bailey of the Lone Star-Surprise group at Republic, Wash.; Preston Locke of the American Smelting, Refining and Mining Co.; John T. Burns of Denver, Western secretary of the American Mining Congress; Henry Landes, state geologist of Washington; L. O. Howard of Washington State College; Francis A. Thomson and D. C. Livingston of the University of Idaho, and Thomas Varley, C. A. Wright and W. H. Coghill of the U. S. Bureau of Mines.

The Bonus System Applied to Mining

By W. V. De Camp*

Several articles have appeared lately in various technical publications, dealing with the bonus or contract system as applied to underground labor, but in all this mass of information and opinions there is one important consideration that has not been dwelt upon. In mining work the Blue Bell mine is trying to adopt a bonus system, which works out with excellent results in a shop where the piece-work system is successful and where it is possible to limit the operations and movements necessary to do a certain job; but when attempt is made to adopt the method underground, it often fails miserably, which is due to the many variations in the character of the work.

Occasionally there are certain classes of work which can be placed on a definite bonus system and which will work out satisfactorily both for the employee and the employer—such work as shoveling in a large stope where there is a constant supply of broken ore, or in tramming ore or waste on a level where the operation is definite and the supply more or less regular. Also certain classes of work, such as drilling in a large stope where the conditions from day to day do not vary too greatly, or in driving a drift or crosscut where the ground is uniform in character.

Delay in Computing Bonus Breeds Dissatisfaction

When such conditions are constant enough one is able to estimate a certain task for a day's work, and any unit of work above this task can be used as a unit for a bonus to the workman concerned. The amount to be paid is generally determined at the end of two weeks or a month, as the case may be, and at the end of that period the company engineer measures up the particular working place and calculates what the daily output has been; after which a bonus notice is posted to the effect that John Doe has earned a bonus for the period of a certain amount per day. John Doe, on seeing this notice, if he happens to think he has earned more than is stated, is inclined to be peeved, and decides in his own mind that the system is a fake and designed for the company alone; that he will get paid only a certain amount anyhow. As a result he ceases to put forth any effort toward earning a bonus, and since he waits 15 or 30 days to find out what his earnings were, he is likely to slow down to a leisurely pace and forget about the bonus.

The above statement is made from observation during many years of effort to institute a bonus system for general mining work that will be satisfactory both to the employee and the employer, and carries a full realization of the many difficulties to be expected. As a result of this experience the conclusions I have reached are that the principal fault lies with the employer, in that he does not give his bonus system sufficient supervision; and both close supervision and a daily check on results are necessary to success.

For the average miner or laborer working under a bonus system it is not sufficient to know the results of his labor every 15 or 30 days. He should know positively at the end of every working day, or before he goes to work the next shift, what he has earned. This is not a new idea by any means, but it is a psychological fact that whatever one succeeds in impressing most forcibly on an individual's mind will eventually become his most marked point of view. To apply this to mining close supervision is essential, and it becomes necessary to reduce the number of men working under each boss or, what I consider much more satisfactory, to employ a separate checker to handle bonus details for from 30 to 40 men. This man can be directly under the shift boss, but gets his bonus rates from the mine office, as determined for the various working faces, and is directly responsible to the office for the results of his work. He should be supplied with record cards showing the working place of every man and should detail on these the class of work and the amount of bonus earned by each. The card records can then be summarized daily, and a notice posted to the effect that certain men have or have not made a bonus. It is just as essential that the bonus earners be posted as it is for those that have earned none. By posting the notices daily every man is made acquainted with the earnings of himself and others.

The bonus idea should thus be kept alive in the minds of the men, and if any question arises it can be brought up and settled at once. The miner working in a drift should know just how much ground he is breaking per round, which makes daily measurements of every heading necessary. The cards for each working place should state the time lost due to causes not under the control of the man, and the shift should be divided into two parts. Thus if a miner is held up all the morning by being forced to bar down a dangerous back, and in the afternoon does an unusual amount of work, he should receive credit for the full shift at the same rate of earning he has made during the afternoon. Bonus rates should be posted on each level or at the entrance to each working, and every new man starting to work should be made fully acquainted with the methods in use and rates of pay and bonus.

This may appear complicated to the manager, and the idea of increasing the number of bosses and clerks will probably meet objections, but once the confidence of the men is obtained and the system well started it will work out nicely and will tend greatly toward maintaining or increasing the average rate of the work performed.

Care Essential in Figuring Bonus

As to the method of determining the bonus to be paid in a particular case, I have found that one cannot be too careful in establishing this figure, and, once established, the rate should not be changed except in the event of a change in wage scale or the adoption of some new condition or mining method that would make the old rates impossible. Careful records of past performance and a study of actual conditions should be made as the basis of the rate, and I have found that where a certain amount per man has obtained for a certain period it is well to accept this as the base rate and begin the bonus from this point, increasing at a regular rate as the work increases. In the event, however, that the employer feels that the average has been entirely too low, it is well to begin at a low rate and gradually increase the unit rate as greater output is obtained.

As an illustration of the first case, assume a carman tramming 30 cars per day from a certain chute. The

*Mine superintendent, Blue Bell mine, Mayer, Ariz.

cost to the company on a base rate of $5 per day will be 16.67c. per car. With a bonus based on 50% of the cost the carman would therefore receive, say, 8c. per car for every car over 30. If he can save a little time at the beginning and end of the shift and not "take five" too often, it would be quite possible for him to increase his output by four cars, thereby increasing his wages 6.4% and decreasing the cost per car to the company by 6.06%. This means a direct saving of approximately 34c. per carman per day for the company. If the same amount could be saved on the labor of 40 men, it would be sufficient to pay the wages of the extra boss and leave a good margin for the company.

In a drift where the average footage advance has been four feet per round at a total cost of $20 for miners and muckers, or $5 per foot, the bonus to each man working, assuming the employment of two carmen and two miners, might be placed at 50% of the total saving made. Thus: 4½-ft. advance at $21.25 costs $4.72 per ft., and 5-ft. advance at $22.50 costs $4.50 per ft. A direct return to each man at the 4.5-ft rate of 31c. per day and of 62c. in the last case.

One thing that should never be attempted is to so arrange the bonus so that it will always be constant. I have often heard mine superintendents say, We want our better class men to earn at least 25c. per day more than the scale. This is a grave mistake and one that will result in the slowing up of the men, as the incentive is then taken away, since this constant bonus, in the eyes of the men, will mean nothing more after a certain period than a straight increase in wages, and they will lose sight entirely of the bonus idea. This was aptly illustrated a few years ago in the copper mines of Arizona. When copper went up the companies raised wages a certain amount per unit increase in copper, with the result that every man, from the mine superintendent down, felt, after the lapse of a few months at the increased wage, that his value to the company was the total wage paid, and lost sight of his base rate entirely. If the companies at this time had taken the trouble to issue two different checks for each period worked, one check for the number of days due at the base rate and the other check of different color for the copper bonus paid, it would have resulted in every man's looking upon that bonus check in an entirely different light and would have kept constantly in mind his actual base rate and the amount he was earning because of the increase in the price of copper.

The bonus or task system, to be entirely successful, should be handled in a similar manner, and if rules were to be established for a bonus system they should be grouped as follows:

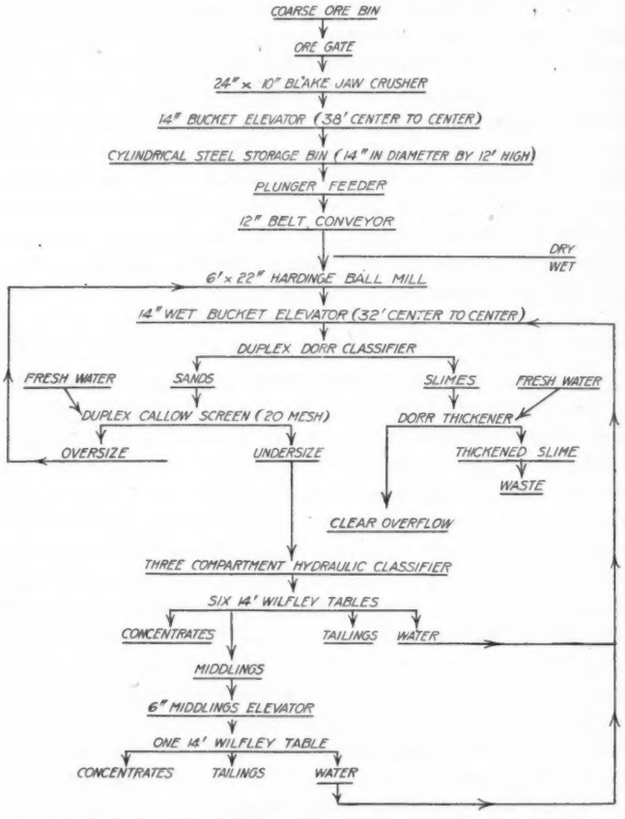
1. Never change a bonus rate.
2. Notify men daily of amounts earned.
3. Notify every man when he starts of the exact conditions under which he is working, bonus rates, etc.
4. Keep the bonus idea constantly in mind.
5. Pay all bonus by separate check.

Graphite Deposits in Spain are to be exploited in the vicinity of Checa, in the Province of Guadalajara, according to *Echo des Mines*. The ore is stated to occur in beds in Silurian strata, to have a thickness exceeding 1 m., and to outcrop over a distance of about 1500 m. It appears that some graphite in the form of "bars" and "large crayons" has already been forwarded to Barcelona and Valencia.

Concentration of Chrome Ores

Little has been done in the United States in the concentration of chrome ores. Chrome sands have been treated on buddles, sluices, etc., but until recently no serious attempt was made to beneficiate lode chrome ores, beyond the hand sorting practiced at nearly every chromite mine. In 1917 two concentrating mills were under construction in California, which has lately produced most of the chrome ore of the United States.

In discussing the concentration of the California chrome ores, Preliminary Report No. 3 of the California Mining Bureau stated that a mill was under construction near Patterson, in Stanislaus County, for the Chrome Concentrating Co., of San Francisco, and that the Placer Chrome Concentrating Co., of Newcastle,



FLOW SHEET OF ST. FRANCIS CHROME MILL

had built a mill one-quarter mile south of Rattlesnake Bridge, in Eldorado County. The latter mill consists of a 4 x 6-ft. grizzly, 8 x 12-in. Blake crusher, Hendy self-feeder 4 x 5-ft. ball mill, two Deister-Overstrom concentrators and one Deister simplex sand concentrator. In a test run made in October, 1917, it was noted that there "was a tendency for the ore to slime, which could probably be remedied only by substituting rolls for the ball mill."

In Canada, several concentrating mills have operated in the Black Lake district of Quebec. The Mutual Chemical Co. of Canada operates two concentrators in this district, the Lake Side mill, under lease from a local company, and the St. Francis mill, a new plant built in 1916. The company, under date of Apr. 24. 1917, gave a brief account[1] of its operations to the

[1] "Chromite in 1916," by J. S. Diller, "Mineral Resources of the United States, 1916," Part I, pp. 21-38.

U. S. Geological Survey, and while in the main the concentration of chromite is similar to that of other ores, it is interesting to note details as to equipment and other data contained in the company's statement which is reproduced below:

Lake Side Mill—The Lake Side mill is situated about two miles south of the town of Black Lake, on the line of the Quebec Central R.R. This mill, built about 15 years ago and abandoned in 1909, was refitted along the original lines during the summer of 1916. The equipment consists of:

Receiving bin, capacity 75 tons.
One 9 x 15-in. Blake jaw crusher.
Elevating and conveying equipment for distribution of ore to stamp-battery bins; capacity 35 tons each.
Thirty 950-lb. gravity stamps.
Seven 16-ft. Wilfley tables.
Concentrate collector boxes and storage shed for concentrates.
Water-storage tank.

Ore is hauled to the plant by wagons, which deliver either into the mill bins or stock pile, as desired. The plant is driven by electric power. The water supply is pumped from Black Lake, a distance of 700 yards, under head of 180 ft., by means of a 7 x 9-in. triplex plunger pump, belt driven.

The essential features of the milling system are as follows: (*a*) Reduction of ore to about 2-in. maximum size by means of the jaw crusher; (*b*) crushing by stamps to pass 29-mesh screen; (*c*) stamp product fed directly to Wilfley tables; (*d*) middlings from six tables, without regrinding, concentrated on one table, to which they flow by gravity.

It will be seen at a glance that the above outline embodies the simplest possible system of gravity concentration, corresponding to concentration practice of some 15 or 20 years ago. In refitting the mill, the original design was nevertheless adhered to, as the very limited tonnage of milling ore that could be assured at the time made it advisable to limit expenditures to the minimum. The milling results covering the eight months of operation, Aug. 1, 1916, to Apr. 1, 1917, are substantially as follows:

Ore milled per day, long tons	70
Water consumption per ton of ore milled, long tons	7—8
Average content in chromic oxide, per cent	12
Recovery, per cent	65.8

St. Francis Mill—This mill, built during the latter half of 1916, at the company's own mines, is about four and one-half miles southeast of the village of Black Lake. The nominal capacity of the mill is 80 tons per 24 hours. Electric power is used throughout. The requisite water supply, 65 gal. per min., is pumped a distance of seven-eighths of a mile from a small lake approximately 120 ft. below the level of the main storage tank near the mill.

The accompanying flow sheet indicates the milling system and equipment employed. Attention might be called to the following conditions which influenced the design of this plant:

1. Desirability of economy in water consumption—Excess water in slimes produced in grinding, as well as excess water from all the tables, is returned to the Dorr thickener, where the contained solids are settled out and the recovered clear water is made available for re-use. The net loss of water is thus reduced to substantially the amount required to carry away the tailings.

2. Asbestos fiber in the ore—In the earlier stamp milling of the ore a good deal of difficulty was encountered as a result of the "blinding" of the battery screens by asbestos fiber. The idea that this difficulty would be entirely avoided by the use of the Callow traveling-belt screen has been proved to be correct during the short time that the mill has been in operation. It has also been found in actual operation that a considerable portion of the fine asbestos fiber is floated out in the slimes overflow of the Dorr classifier.

3. Chromite in the slimes—It will be noted in the accompanying flow sheet that no provision was made for the concentration of the slimes produced in grinding. It was reasoned that by providing ample capacity in the Dorr classifier the operation of this classifier could be so controlled as to effect the settlement, along with the sands product, of a large proportion of the slimed chromite. Operations thus far have shown that this settlement takes place to a considerable extent, but the mill has not yet been in operation for a sufficient period to allow of reaching a definite conclusion as to whether slimes concentration can profitably be dispensed with.

It might be added that the normal price of chromite concentrates, carrying 50% of chromic oxide, fixes a limit on operating costs, which does not permit of elaborate refinements in the system of concentration employed. The equipment noted is all standard equipment in wide use in wet-milling practice, and its use in this case is novel only as being applied to the treatment of chrome ores.

Adverse Factors Affecting the Transvaal Mining Industry

On Jan. 15, E. A. Wallers, president of the Transvaal Chamber of Mines, speaking of the difficulties of maintaining the gold output, said: "Three factors are seriously affecting the industry adversely: (1) The heavy increase in the cost of mining materials and general working expenses, which eliminates the margin of profit on the low-grade section; (2) the acute native labor shortage; (3) reduction in nitroglycerine supplies.

"If the last two difficulties were susceptible of a marked improvement, the industry could probably be carried on for some time on the present basis, notwithstanding the fact that the first difficulty is growing more acute. It is unlikely, however, that such a marked double improvement can take place. The native labor force now shows a slight seasonal increase, but with the return of seed-time this improvement will probably disappear. If neither native labor nor the explosives supply can be maintained even at the present level, then the problem of maintaining the gold output for Imperial purposes and continuing operations in the mines on a sufficient basis to prevent unemployment, and so conserve the prosperity of the Union, would become most difficult of solution.

"As regards nitroglycerine, the industry has economized to the extent of 25% since the war started, and the limit in this respect appears to have been almost reached. The further reduction of 21% required by the Imperial government combined with the Union government's instructions to the effect that the supplies on hand in this country must be conserved has necessitated research for substitutes.

"The most probable position is, therefore, that the native labor supply will neither appreciably improve nor become much worse, while the explosives shortage may be somewhat relieved by the use of substitutes. In that case the difficulties appear to be surmountable with government assistance and the rearrangement of the operations of the industry as a whole, with particular reference to two points—namely, the necessity of maintaining the gold output and of maintaining the prosperity of the Union. I understand that the Union government is losing no time in thoroughly investigating the position with a view to arriving at a solution."

Salt Production in continental United States, Hawaii and Porto Rico in 1917 was 6,946,000 short tons, an increase of 583,000, or 9%, over 1916, according to the U. S. Geological Survey. Michigan led, with an estimated production of 2,294,000 tons, and the New York output totaled 2,175,000 tons. Ohio produced 954,000 tons, Kansas 726,000, California 178,000, Texas 86,000, Utah 65,000, West Virginia 20,000, and Hawaii, Idaho, Louisiana, Nevada, New Mexico, Oklahoma, Porto Rico and Virginia combined, 447,800 tons. Given labor and transportation, salt producers of the United States can more than supply the nation's needs.

The Incline Top-Slice Method Applied to Large Orebodies

THE incline top-slicing method practiced by the Arizona Copper Co. at the Coronado mine, at Metcalf, Ariz., as described by P. B. Scotland in the *Journal* of Apr. 7, 1917, is being applied to an orebody varying from 20 to 40 ft. in width. This system may, however, be used to advantage in larger orebodies adapted to the top-slicing system by sectionalizing the ground to be stoped, and a method of so doing is described by W. G. Scott[1] in a paper presented at the February meeting of the American Institute of Mining Engineers.

In laying out the orebody for stoping operations, it is cut up by sub-levels into 50-ft. blocks, as shown by Figs. 1 and 2, according to methods 1 and 2. A drift is run through the center block lengthwise of the orebody. From this drift crosscuts are run at right angles every 50 ft. to the end of the block. Sub-levels are spaced every 55 ft. vertically, or in multiples of 11 ft., which is the height of a slice. Drifts and crosscuts should be run directly above one another, and sub-levels are practically duplicates in so far as the size of the orebody on the different levels will permit. Drifts and crosscuts are run off center in relation to the block lines in order to allow the shrinkage stopes and chutes to be carried up in the middle of the blocks. This allows for better drawing-off conditions from the chutes, provided it is necessary to transfer the ore on the sub-levels as shown by Fig. 3. The preparatory work necessary in method 1, using small shrinkage stopes for chutes of which Fig. 1 shows a plan and cross-section, would be 200 ft. of drifting, and 150 ft. of raising for manways and timberways, amounting in all to 350 ft. This section would contain practically 35,000 tons of ore (based on factors in this district), which would show a production of practically 100 tons of ore for every foot of preparatory work. The shrinkages are not counted in this. They are run 3 or 4 ft. in width through the block and from sub to sub and produce a good tonnage from the start. All this work would be in ore. No arrangement is shown for disposing of the ore. It is recommended that drawing-off chutes be placed at each sub where the surplus can be drawn off as required, either into cars and run to transfer chutes, or the chutes from below be arranged to come up into each block and the ore diverted into them direct from the drawing-off chutes (the latter is the Coronado practice). These chutes, later would answer for part of the shrinkage as the blocks worked downward, as shown in Fig. 3.

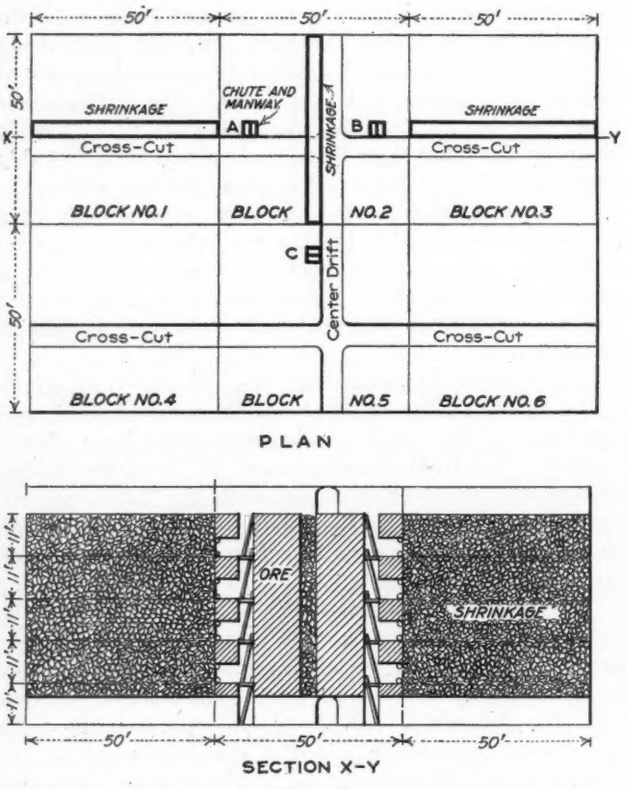


FIG. 1. FIRST OR SHRINKAGE STOPE METHOD

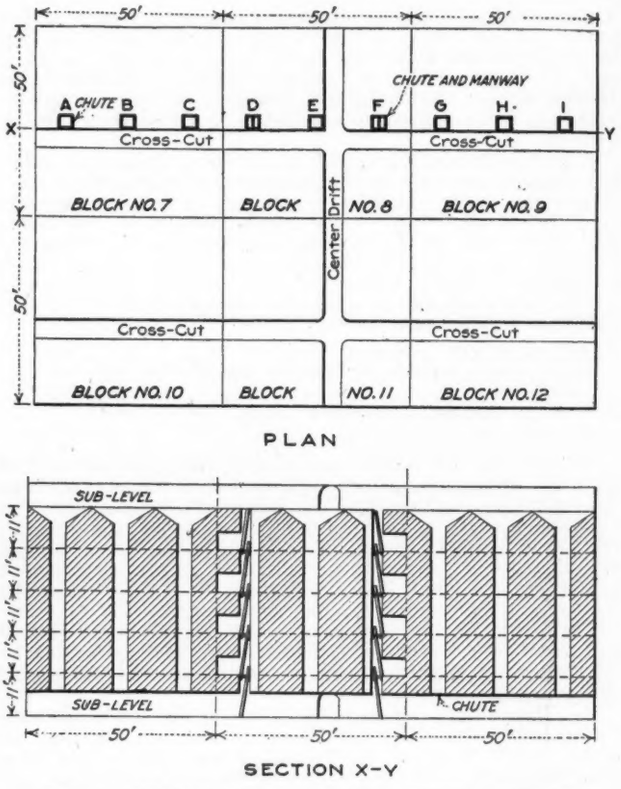


FIG. 2. SECOND OR RAISE AND CHUTE METHOD

In method 2, using all chutes of which Fig. 2 is a plan and cross-section, the preparatory work would be considerably more, amounting to 200 ft. of drifting and 450 ft. of raising, in all 650 ft., which would produce approximately 55 tons of ore for every foot of preparatory work. This would likewise be all in ore. The drawing off of the ore at the sub-level would be the same as in method 1. Break-throughs or connections, every 11 ft. vertically, as shown in cross-sections, are

[1]Mine superintendent, Coronado division, Arizona Copper Co., Metcalf, Arizona.

run from the manways into the slices and are not figured in, being taken care of with the stopes as required.

With either method, the operation of the slices would be the same. Panels 10 ft. wide are started up on a 33° incline at right angles to the shrinkages or line of chutes. Slices are always started at the side furthest from the manway and run up until the end of the block or mat of the stope adjoining is reached. This is repeated, retreating towards the manway, the panels being shot down as fast as they are worked out.

Referring to Fig. 1, the shrinkage method, it will be noted that it provides manways in the clear of the ore being immediately stoped, so no extra precaution need be observed for a safe retreat, whereas with method 2, the all-chute method, the reverse is the case.

Details of First Method

Stope out blocks 1 and 3 first. Entrance to the stopes is made through manways *A* and *B*, block 2, when blocks 1 and 3 are stoped out down to the first sub-level. Stoping can then be started on block 2, entrance being

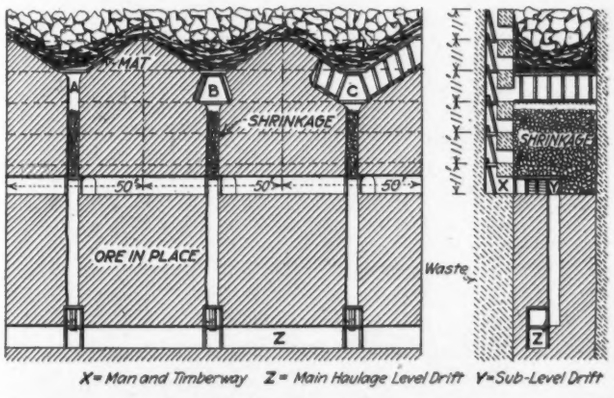


FIG. 3. LONGITUDINAL AND CROSS SECTIONS OF OREBODY, SHOWING PROCEDURE BY EITHER METHOD

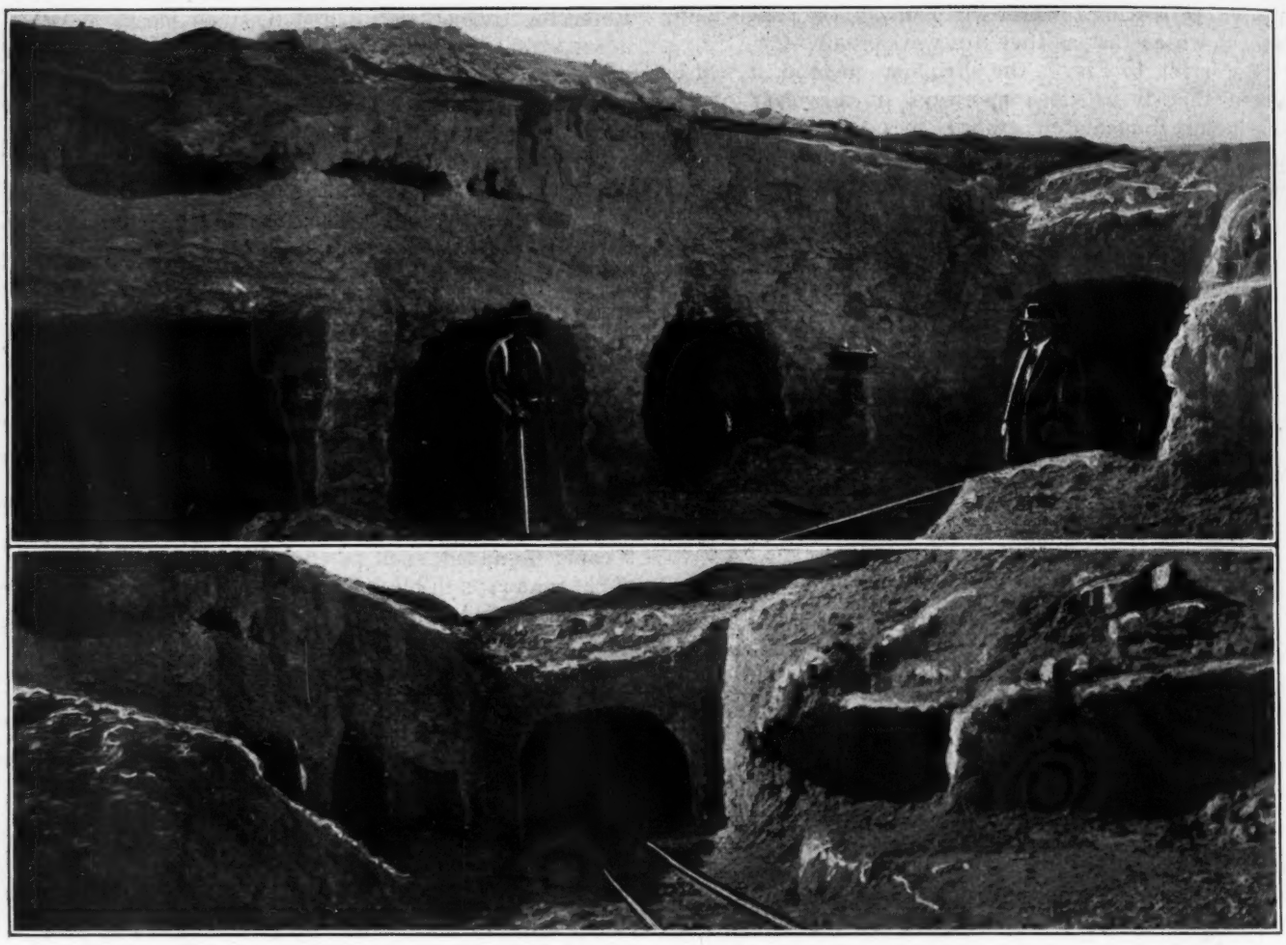
made through manway *C* in block 5. Entrance to blocks can be made through either top or bottom sub, as convenient. After blocks 1 and 3 are stoped out for a couple of slices, and it is decided that block 2 should start producing, entrance can be made to blocks 1 and 3 from sub-level below, while entrance to block 2 can be made from sub-level above. Manways *A* and *B* can be bulkheaded over and filled with ore, so there need be no interruption in working the three blocks together in this manner. However, if the latter plan can be avoided, it would simplify working conditions if the side blocks could be kept 55 ft. in advance of those in the middle, this being the distance between sub-levels. When the mine is once in that state, the entire area can then be stoped without interruption. By keeping the middle blocks one sub-level higher all the time, the ventilation of the side blocks would be greatly improved. Then again, the nature of the ground might not permit cutting these middle blocks or pillars through the center with a shrinkage stope as shown. If there is any doubt about the advisability of this, the shrinkage stope could be left out and a chute run up in the center instead. Thus the block could be mined out as in method 2. Repeat in the same way with the adjoining blocks, 4, 5, 6, etc. The manway *C* in block 5 will be included in the shrinkage when the latter is brought up in that block. "Break-throughs" are run every 11 ft. from the manways. They serve as entrances to the shrinkage as it ascends and to the slices as they descend. The manways are all divided off with a timberway on one side.

Details of Second Method

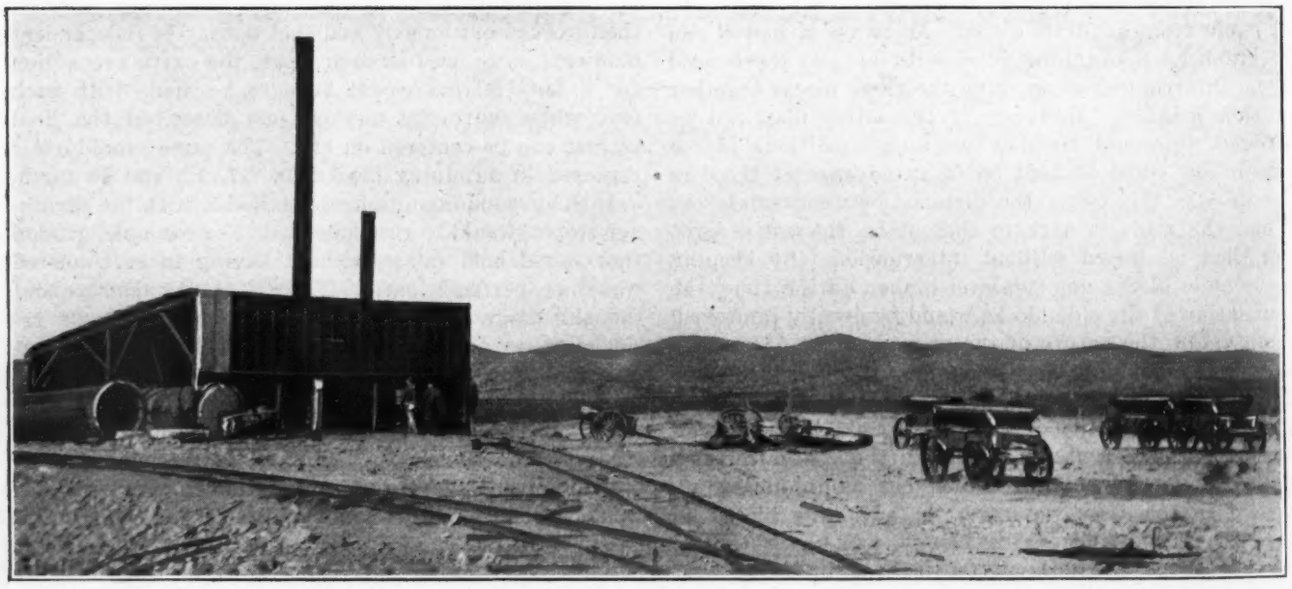
If the ground is too soft to permit the use of shrinkage stopes, chutes can be used throughout instead. Referring to blocks 7, 8 and 9, stope blocks 7 and 9 down to sub-level first, entrances being made through manways *D* and *F* in block 8. This will necessitate cutting through from *F* to *I* and from *D* to *A* on each floor before starting the slice. This cut, taken out 11 ft. high to the mat overhead, would be producing from the start and should not make much of a break in the tonnage. The tops of the chutes could be inclined toward each other until they almost meet, which ought to make the production of the stope practically as high as if it had the shrinkage through the center, as in method 1. By having entrances through *D* and *F*, block 8 only, it would be necessary to finish 7 and 9 down to the sub-level before starting to stope block 8. This would reduce the number of manways, only two being necessary for the three blocks. If it is not considered advisable to hold the middle block up while the two outside blocks are being stoped out to the sub-level, a manway in each of the blocks 7 and 9 could be added, such as *C* and *G*, in which case one of the manways in block 8 could be omitted. This would provide an independent manway for each block, but it is a question whether it will be as convenient as it looks; for in this method we have to figure on a final retreat at the wind-up of each slice. This would be simplified by centering on one of the manways in block 8, such as *D*, in which case we will consider blocks 7 and 9 finished down to the sub-level, entrance to same being already explained. To proceed with block 8, a cut is taken across the stope in the regular way, and up to the mat overhead, connecting chutes *D*, *E* and *F*. Slicing is then started at *F*, retreating back, panel after panel, until *D* is reached. All the stoped portion is blasted down, leaving a panel intact around *D*. Some extra reinforcing may be necessary to make sure of holding this manway open. This remaining panel is then worked out quickly and shot down. If independent manways were used in each block, the extra precaution for a final retreat would have to be made with each one, where with the method just described the final retreat can be centered on one. The same procedure is repeated in adjoining blocks, 10, 11, 12, and so forth.

If the ground is quite firm, method 1, with the shrinkage stopes, would be recommended. For example, ground that would hold raises without having to be timbered would be perfectly safe. If there is any doubt about the shrinkages not holding, chutes had better be resorted to, as described in method 2. The monthly output that could be expected from each 50-ft. block, working two shifts, would be between 2500 and 3000 tons. If the ore is soft, that could probably be exceeded. The system as described is intended for an orebody about 150 ft. in width. A much greater width would probably require another set of drifts and crosscuts. Branches or swells that would interfere could be handled separately, something on the order of the Coronado system.

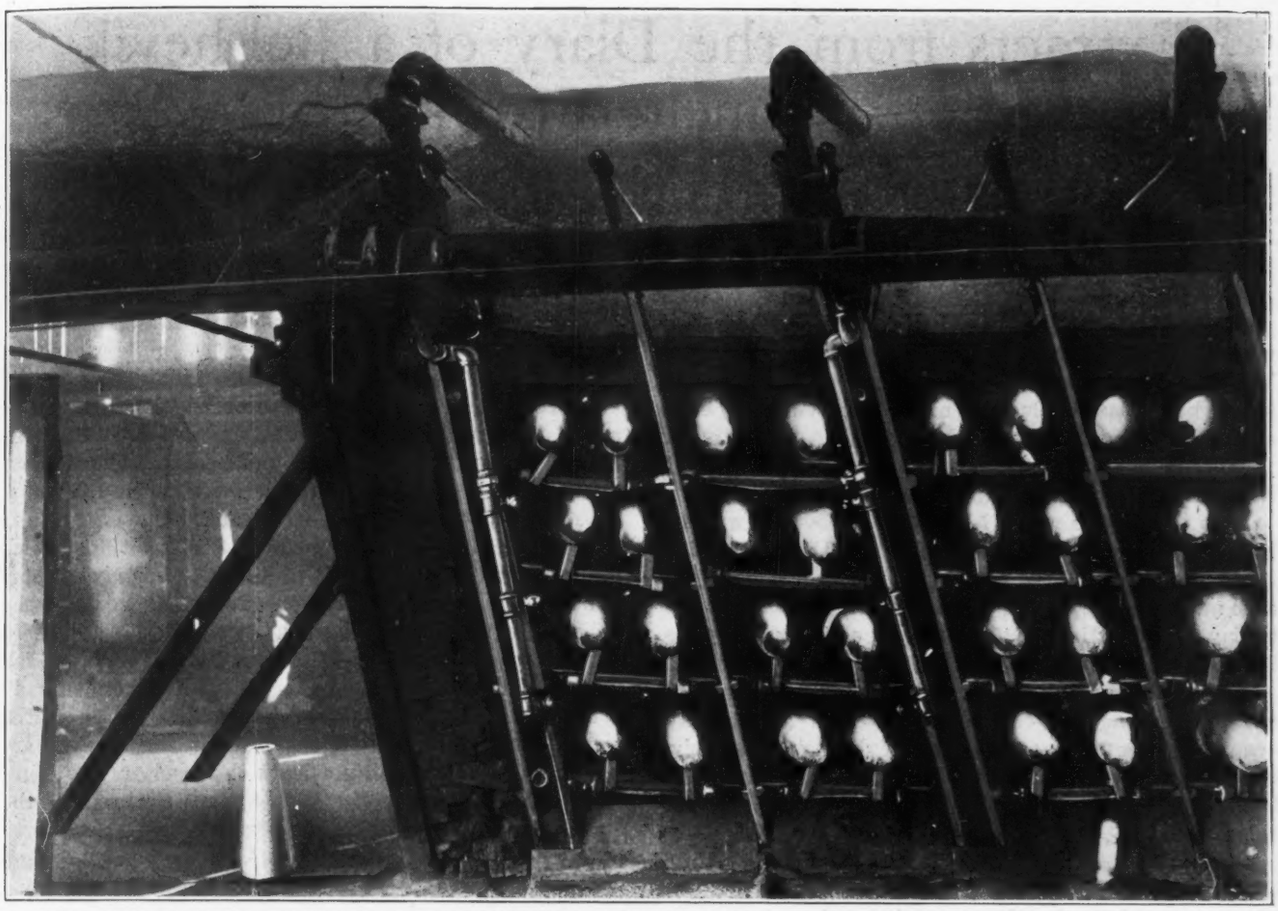
Photographs from the Field



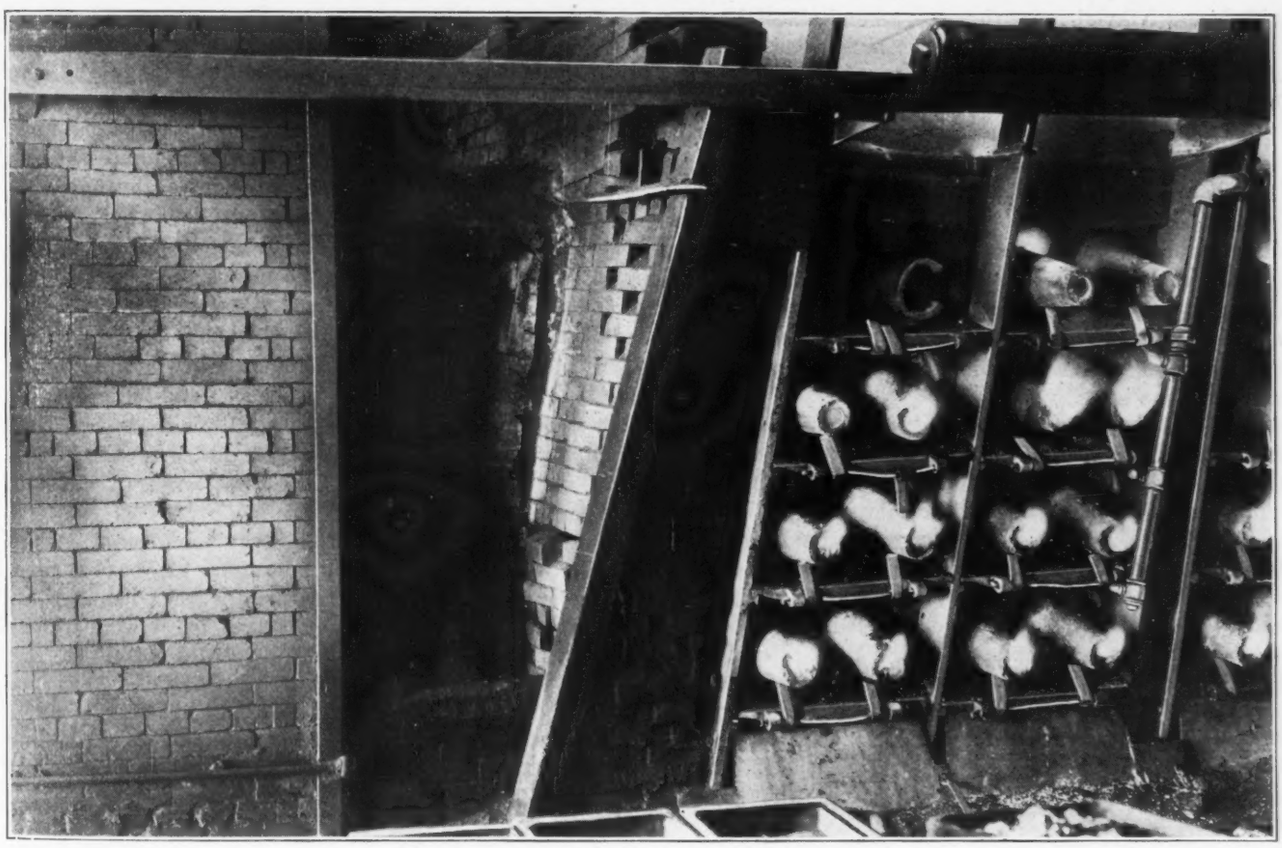
WORKINGS OF GULF SULPHUR CO., CULBERTSON COUNTY, TEXAS, WHERE DEPOSITS OF 90% SULPHUR OCCUR



TREATMENT PLANT FOR SULPHUR ORES IN CULBERTSON COUNTY, TEXAS, SHOWING RETORTS USED



ZINC DISTILLATION FURNACE IN THE NATURAL GAS DISTRICT OF OKLAHOMA, STILL IN OPERATION BUT ABOUT TO BE CLOSED DOWN FOR REBUILDING



ANOTHER FURNACE IN THE SAME WORKS

The lower photograph shows the chimney end, while the upper photograph shows the opposite end. The distortion of these furnaces is rather unusual.

Extracts from the Diary of a Bolshevik Smelterman

By J. P. Hutchins*

MARCH 7th, 1917. I did not work today. I have not worked since Saturday. Why should I work when I have plenty of money and there is so much copper piled up at the railroad station? I cannot understand why we are urged to work so hard to make more copper that no one cares for enough to haul away. The American foreman at the smelter works very hard; he works at least twelve and often fourteen hours every day, while I work only eight or ten, but then his pay is more than mine, and he ought to work harder. He says we ought to make copper as fast as possible so as to help to win the war. I cannot see how my working harder to make copper will help to win the war, and, if it is necessary to have copper, why does not some one take away the copper lying at our railway station? Yesterday, while sitting on the platform of the railway station, a freight train came along from Vladivostok. One of the cars was loaded with copper, marked with some queer letters, not like our Russian letters. It must have been copper from abroad. But why do they use foreign copper, leaving our beautiful Russian copper, which looks just as good, lying for weeks at the railway station? I cannot understand all these queer things that have happened since the war began anyway. I think the Czar does not keep his promises. He promised that the war would not last long, and it has lasted over two years, and my oldest brother, Ivan Ivanovich, has been killed, and Nikolai Ivanovich, my second oldest brother, is a prisoner in Germany, and we must send money to him, and Alexander Alexeivich, my cousin, has come back with his eye blinded and his left leg shot off by a bullet, and they only gave him a wooden leg that does not fit him, and he can only walk slowly because the leg is so heavy and he gets very tired. He will never again be able to work in the fields or to dance the gopak, and he was such a good dancer, the best in the village, and Maria Petrovna, who was going to marry him, now says that she will not marry "a piece of a man who could not get food and clothes for the children." Poor Sasha! He will have to be a watchman at the wood yard, if he can get a job at all.

My son, Peter Ivanovich, was wounded in Galicia while he was fighting with a club, for there were not enough rifles—only one rifle for three men. But there will be enough rifles when all the soldiers finish the war to bring home, when we will show some one something, for all the soldiers say they will bring their rifles home with them. Peter Ivanovich was shot in the right leg, and he did not have his leg well nursed, and now it is shorter than the other and stiff at the knee. He says the nurses were lazy and did not take care of his wound at night, but snored in their beds; he could hear them. How will all these crippled and blind men live? Lucky I have plenty of children and Peter Ivanovich plenty of brothers. Perhaps they will help him; who knows? The devil, perhaps.

I don't like this war. They take all of our best men and best horses. The horses never come back, and the men don't come back at all, or only come back all shot to pieces. I wonder if we will have enough men to plant the wheat and rye. Last year we had to leave the smelter, which was shut down for weeks, while we sowed the fields and gathered the harvest. This year it will be worse. And soon Easter will be here, and it will be sad, for we will not have vodka, but will have to drink honey beer, which costs very much and it gives me a terrible headache. Last Sunday I visited at the house of Alexei Petrovich, and we drank honey beer, and how my head ached all Monday! I did not feel much like working Monday, and I did not work yesterday either. The Little Father took away our vodka when the war began, but promised that we could have it again after the mobilization was finished; but the mobilization never finishes. The Czar has not kept his promises. In a few days, the men 43 years old will be called to the war. Lucky for me that the men at the smelter are not to be called. I will not leave the smelter.

Yesterday I went to the shop to buy clothes, for the owner, Jakob Abramovich, expected to have a new party of clothes. It had not arrived, and so I must go on wearing my old velvet breeches, although they are worn out and although I have plenty of money to buy new breeches. Yesterday afternoon I played cards with three friends who were not working. I won 43 roubles and 67 kopeks. This was lucky for me, for I often lose to the Strange Men who come to our village and play with us and then go to the next village. They seem to always win and have wonderful luck, the devil knows why. These Strange Men have only come since the war began. Before the war we did not have any money to spare for gambling. Now we have plenty, but we cannot buy anything, for the shop has no goods, and we can't buy vodka; and so we gamble and lose to the Strange Men.

Tomorrow I will go again to Jakob Abramovich to see if his party of goods has come. I like him, although he is a Jew, for he will sell his goods and he is not like the shopkeeper at the mine, who, although he is a Russian, refuses to sell his goods, for he says that he can buy no more and that he does not want to have an empty store.

March 19th. I have not thought much lately except about this terrible war, and now there has been a revolution in Petrograd and the Little Father has lost his job and his uncle has refused to take it. I wonder why the Grand Duke Nikolai Nikolaievich did not get it. He is a great man and a great hero. Why did they fire him, or was he so good that they did not like him? I cannot understand. One day they said the Czar was our Little Father, our protector. Now they say he was a traitor. They said our Holy Church was our friend. Now they say it was not. I never liked our village priest, because he always tries to get money from me. I don't mind if he gets drunk and gambles, for all men

*Mining engineer, 120 Broadway, New York.

must do this. Now they say that the Jews are comrades and must not be abused. I never hated the Jews very much, and Jakob Abramovich always kept a good stock of clothes, and will sell me what I want if he has it, not like the Russian shopkeeper at the mine.

It is hard to work now, for there are queer reports being talked over by the men, and I like to discuss them, too. The American foreman tries his best and hardly goes home at all, but sleeps at the smelter. Why do people want to work so hard? The manager, who is also an American, called all the workmen together and made a speech yesterday. He tried to explain what had happened at Petrograd, but I could not understand him, as he talks Russian very badly. He has been here several years, but does not talk well. I wonder if all the Americans are so stupid, and must work so hard like they do to make up for their stupidity. But I like him anyway, because he is so fair.

April 28th. We have had several raises of wages, and now I work only about half of each week; for I make as much now in half a week as I did before in a whole week. Our American foreman works harder than ever, and, he says, for the same wages. He seems to be a fool, for all of us workmen have had raises. We now have a Sovyet here, and I am a member. We have made demands of the American manager for more wages, and have had to threaten to stop work before he would consent. But he consented at last. He told us that our country needed copper more than ever; but how can that be true when there are always several big piles of copper lying at the railroad station? I asked him about this, but he said that he could not get cars to ship it in. Why do they not give cars if they want copper so badly? I am more puzzled than ever and I wish the infernal devil-bred war would end so we could be like we were three years ago. Then I received only one rouble a day, but I could buy things. Now I get twice as much, but I cannot even buy tobacco now, for there is none in the store. My velvet breeches are almost in rags and the clothes of my wife and children are quite worn out. They tell us that we are going to get more land. That will be good, and we will then be able to let our land lie fallow oftener than once in three years, as we have always done. We planted our seed, but not as much as last year, for we still have some of the last harvest left, and labor is scarce. The devil take the war!

June 30th. Still I wear my poor old velvet breeches, for I cannot buy new ones; there is no velvet in the shop. I have more money than ever before. The Sovyet has made the manager give us higher wages, and now I receive three times as much as a year ago. The manager told us that the company was losing money, but we did not believe him, and then to prove it he showed the books to a committee, of which I was a member. I could not understand them, and we think they must be false and made up to deceive us. One thing I saw, and that was that the Americans were receiving much larger wages than the Russians. We do not like them, and Dimitry Pavlovich, who has worked in Moscow, says it is not right and that we ought to receive the same wages as the Americans. Evgenee Kcenievich, who has come from Petrograd, agrees and says we can run the works as well as the Americans, and that we ought to run them ourselves. But most of us, especially those who have not been in Petrograd and Moscow, do not agree.

July 7th. We had a row last night, and one man was stabbed. Several soldiers have returned to their homes in this village. They say they came back to be here when the land should be divided and so as to be sure to get their share, but the land has not been divided. I think they came without permission, for none of them have their passports. They treat all who have not been to the war as inferior. Last night several of them had been drinking honey beer, which always gives me a terrible headache, and insulted Maria Petrovna, Lydia Ivanavna and Nadezhda Nikolaevna. Their husbands were very angry, and there was a fight, and several other villagers joined and gave the soldiers a good beating. The soldiers say we live like pigs and don't know anything. Perhaps we do; I have always thought that we should have had more schools. Why did the government insist that we have a vodka shop, but did not let us have more schools? Education ought to be free, like light and air.

July 19th. The soldiers persuaded us to divide the land of Alexander Mikhailovich, who is a bourgeois and owned 10,000 desiatins, and to take his horses and cattle. We did; and we burned his buildings, too, and his big house. Some of the old men said we were foolish to destroy buildings, but we decided that they were too big to be used by us, and so had better be destroyed. We also burned the village hospital, which was given to the community by Alexander Mikhailovich. I think that was a mistake, for anyone may be sick. Some of the elders said we were ungrateful, but I think Alexander Mikhailovich just gave us the hospital and was kind to us in other ways just to bribe us to allow him to hold 10,000 desiatins. Everybody bribes, anyway.

The soldiers are causing lots of trouble, and want us to take wheat off the freight trains that they say are going to the west, to feed the bourgeoisie, who are our enemies. Alexander Mikhailovich is one of the bourgeoisie, and he has no right to have so much land as 10,000 desiatins.

July 27th. We stopped a freight train and took ten carloads of wheat and rye. This is easier than harvesting the grain, so some say they will not bother to cut their grain. I am going to cut mine anyway; one may need it later.

August 11th. We have had several meetings and have at last decided to run the mine and smelter ourselves. We have fired the Americans and put the works in charge of a committee from the Sovyet, and I am a member of the committee. We have doubled all the wages again.

August 22d. The furnace burned last night; the night shift was talking politics and not attending to work. The mine is not producing ore fast anyway and we would have shut down anyway until we could get more ore. The men at the mine are not doing their share of the work. We have raised wages again, but I do not know how they will be paid, for we have not much money left in the office safe. Our brothers in Petrograd tried to put down the bourgeoisie last month, but Kerensky prevented. But we will try again later.

September 2d. Yesterday was pay day, but there was not enough money to pay all the men, and the last to come to the office did not get any pay. They were very angry, and there was a fight, and Simon Simonovich was stabbed between the shoulders and died in

an hour. The committee has asked the American manager, who is still here, what to do, and he said if we would go back to work for Rs. 2.50 per day, and work faithfully, he would again run the business. Most of the committee voted against it, and we decided not to work at all. But how are we going to live?

September 12th. At last we decided three days ago that it was better to go back to work at Rs. 2.50, and in a day or two the smelter will be blown in again. All the men except those who have been in Petrograd and Moscow want the Americans to do just as they did before the revolution, and we do not think a Committee of Workmen can run the business. I like the Americans pretty well anyway and would not mind if they got better wages than before, like we do. But if this had been a placer gold mine, we could have run it all right. I wonder when all the land will be divided and why nobody keeps his promises! The devil knows.

Of What Use Is the Millionaire?

Somebody has said that "to make a millionaire you have to absorb all the earnings of a thousand men; to make a billionaire the earnings of a million."

The following is the reply of a writer in the *Boston News Bureau:*

In China there are 400,000,000 people. There are no billionaires, and I doubt if there are many millionaires. But, had the energy of a Rockefeller organized China as an industrial producer for the world and for herself, he would have made many multi-millionaires in the process and raised the wages and earnings of 400,000,000 people. Mr. Rockefeller borrowed money and built tank storage for waste oil when people laughed. Was he entitled to only $1000 a year for saving to the world millions of dollars' worth of oil? Everybody had the same opportunity. But nobody had his courage or faith.

Now, if Mr. Rockefeller hired money and then went into China and produced oil and iron and steel and railroads, would he be entitled to your standard of $1000 a year or a Chinaman's wages of not exceeding 10c. a day? If he made 400,000,000 rich and prosperous by the development of their unused underground natural wealth, bringing it to the surface and the markets of the world, what should be his wages? Mr. Rockefeller once said that if he took any pleasure in contemplating his life it was that he had made two blades of grass grow where but one grew before. I know the world would like to take away Mr. Rockefeller's two blades of grass, oblivious of the fact that they would hurt themselves more than Rockefeller. But the pity of it is that such is human meanness, envy, malice and desire to get the fruits of others' toil without entering into their labors, that the world envies the rewards of the men of industry, of invention, and of talent, and would like to divide their wealth and increase idle hours.

Did you ever reflect that there is more value under the surface of the State of Nevada than on the surface of the whole world? But you can bring it to the surface only by summoning accumulated wages of the world, paying for their use by interest or dividends and then organizing your labor units by brain units so that there is economical production. You only look to hand labor, that is the minor labor of the world. What is an army without its general? Are the inventors of the sewing machine, the reaper, the telegraph, the telephone, just $1000 laborers? Who will set a limit to the labor of human brain? Rockefeller, with two billion, may be the most poorly paid laborer in the world, and the man who gets a thousand dollars a year may be ten or one-hundred times overpaid, for he may be a liability and a disaster to his employer and the world. If he added many billions to the wealth of the country, would he be entitled to one for his enterprise in organization, direction and production?

Let me tell you that without the men who earn much more than a thousand dollars a year there would be very few men who would be able to earn that amount. There are in the world but few men of foresight, daring, and enterprise who will risk their fortune in faith in God and man and develop the resourses that lie raw, unused and valueless under our feet. What was the value of this country when 700,000 Indians roamed, or rather fished and canoed on the rivers, and camped on the river banks? Don't you know that the ambitions of men to win fame and fortune, to possess fertile fields and beautiful gardens, to dwell in palaces and give their families luxuries and insurance of future comforts, produce more for the world than for the men of ambition?

The curse of the world today is the socialistic, the I. W. W. and Bolsheviki endeavor to level down the men who are pioneering the world forward instead of levelling up and stimulating all men to possess by production; and then to possess and produce more. Mr. Rockefeller has been the mainspring in the production of fifty billion, and he has not got 5% of what he has assisted to create. Could you in the interest of the world limit his energies, his brain activity or his production? Would you rob him? Would you steal from him? I fear that you would if you could, and that you don't now know it or see it. The pity of it is that such robbery would be a disaster not to Mr. Rockefeller but to the world and millions of men in it.

Your Constitution and ideas are having their exemplification and try-out in starving and disorganized Mexico and Russia. Interest on capital is nothing but the wages of capital and capital is only accumulated wages. Start the world agoing on the land as God made it and it takes centuries for man to battle with the elements of nature, become a producer and learn to think and accumulate surplus production, and surplus production is nothing but the surplus from his labor transmitted in the form of houses, improved lands, developed mines, improved roads, etc., from one generation to another, each generation adding to the accumulated wealth and harnessing it for wages and the production of more wealth.

This has been done in this country to the extent that an American family is able by the use of accumulated wages or capital in roads and machinery to save on the average each year ten times what a Chinese family can earn. In China you can transport a ton a mile for 10c. by human labor. In the United States you do it for three-quarters of a cent. It is accumulated capital alone that has enabled us to do this in America, and yet the envious, the slothful and the unthinking would deny wages to capital which has made the wages and savings of America possible.

Today capital gives the wherewithal to fight for freedom and democracy, for it gives us the railroads, the ships and the factories for powder, gun and shell. Germany is the most highly organized capital state in the world. It has put its capital to bad use, but its entire reliance today in attempted world conquest is upon its accumulated capital, and industrial and financial organization. Prussia has enslaved the country in militarism and is seeking to enslave every surrounding country. Opposed to Germany is the united, cencentrated wealth of western civilization supporting millions of free men on the field of battle.

The hope of Germany for world conquest today lies in the promulgation of poison economic gas—the propaganda with which she misled the 140,000,000 ignorant peasants in Russia. The Hun said to the Slav: "Lay down your arms and take to the land." And then the Hun takes the Slav. Today the same propaganda is being put forth in all the countries fighting for liberty. Labor is told that this is a war of capital, that capital will get the benefit and that now is the opportunity for labor to come into its own by conscripting wealth. Conscription of income in war time is right, but conscription of wealth—the taking of the capital that produces the income—is national suicide. If the German propaganda seeking the destruction of organized capital prevails on this continent, it will be immaterial whether we are annexed to Mexico or to Russia.

All countries will share the same fate.

Bor Copper Mines in Serbia

The *Société des Mines de Bor,* a French company, operated a group of copper mines in the vicinity of Bor, in Serbia, up to the time of the occupation of that country by the Central Powers. The annual meeting of the company was held in Paris on Nov. 20, 1917. According to *Echo des Mines,* no official account of the exploitation was available, but the directors had received news through friends in Geneva who reported that "the work of exploitation by the Germans has been pursued very actively. The district of Bor has been occupied by Bulgars, but German engineers have directed the operations at the mines."

Benedict Crowell, the Organizer

President Wilson is to have his own way in the conduct of the war. Everybody in Washington, including his most vigorous opponents in Congress, has known and secretly admitted that. But his way will be surprisingly similar to the way which the critics among Senators and Congressmen have been urging him to adopt and which he has been refusing to accept as a thing suggested by them, says the *Times*.

In other words, there will be a director of munitions in fact, although not in name. The director will have all the power that Congress has said must be given to somebody—the power to get beyond advising and insure real doing. If he is big enough for the task, he will bring celerity, efficiency, and precision to the muddled operations of the many bureaus and commissions which so far have been engaged, without coördination, in a haphazard struggle to equip the American armies here and abroad with the thousand and one things they must have before America can take a big military part in the war. He will, at least, have the full authority necessary to work such a change.

Such, in brief, is the plan of the President to put an end to the defects of the war-making machinery of the Government. The plan was perfected by Mr. Wilson and Secretary Baker before the now rapidly waning dispute between the White House and the Senate became acute. This explains the President's emphatic, almost angry, objection to the Chamberlain bills to create a War Cabinet and the office of Minister of Munitions. Not only did he resent interference by Congress in what he considered his exclusive domain as Commander-in-Chief of the Army and Navy, on general principles, but he objected to having a scheme so much like his own undivulged plans coming before the public as an invention of the Military Committee of the Senate.

In the time of its incubation, if not in publicity, the plan of the President probably has the priority. At least, so say his supporters. The beginning of its development may be fixed roughly as about the middle of last November, when Benedict Crowell, of Cleveland, was made Assistant Secretary of War. It is nearer the truth, perhaps, to call it Crowell's plan rather than the device of either the President or the Secretary of War. Mr. Crowell, who will be Acting Secretary of War if Mr. Baker makes his contemplated trip to France, will have much to do with putting the plan into effect, as soon as the President, with the new power of the Overman act, can make the drastic redistribution of functions called for by the plan and authorized by the act.

Although he does not admit it under cross-examination, or in speeches before investigating committees of Congress, it is said that Mr. Baker knows that he has limitations, and knows what they are. He came to realize some time ago that business efficiency was the chief lack of his department. He realized that something besides his own idealism and that of the President was necessary to get things done on a quantity production basis and that this something was either not possessed by anybody in his department or, if there, was kept powerless by existing rules and machinery. So the first step in the process of which the Overman bill is a vital part was to call in Crowell on the 10th of November as the successor to William M. Ingraham. Mr. Crowell, whose coming into the War Department has attracted so little attention that his name is not yet familiar in Washington, is an engineer and a chemist and metallurgist by profession.

It was upon the suggestion of Mr. Crowell, soon after he had given up his major's commission to become Assistant Secretary of War, that General Goethals was made Acting Quartermaster General. It was also the suggestion of Mr. Crowell that Edward R. Stettinius be made Surveyor General of Supplies. In having these two appointments made, as well as several others, and in effecting some minor readjustments in the department, the Assistant Secretary was not doing any final things in the way of reorganization. It is now said by the insiders that he was merely getting the parts of the new machine within reach, to be all ready for the assembling process when the blanket power should be derived from Congress to make over the whole machinery of the Government without any legislative restriction.

Sulphuric Acid in 1917

More sulphuric acid was produced in the United States in 1917 than in any previous year. A moderate estimate made by the U. S. Geological Survey shows that the increase in the production of acid of all strengths in 1917 over that in 1916, stated in terms of 60° B. acid, amounted to at least 600,000 tons. In the following figures a certain quantity of the stronger acid reported should really be carried as acid having a strength of 66° B. or less. However, as no data are available to show the proper distribution of all the acid made in 1917, the statement has been prepared as if the reported production were the actual production. The 1917 output was as follows: 50° acid, 2,306,372 short tons; 60°, 1,187,704; 66°, 850,006; and stronger acid, 1,190,019 short tons. Compared with this, the 1916 figures are: 50°, 1,829,471 short tons; 60°, 1,119,753; 66°, 1,580,100; and stronger acid, 443,332 short tons.

The condition of the market for sulphuric acid in 1917 is reported to have been on the whole even better than in 1916, and the value of the product was considerably higher than during that year. Some companies have had difficulty in obtaining sufficient sulphur ore and many of them have been compelled to change from pyrite to sulphur burners. Experiments in the greater utilization of pyrrhotite have been carried on and attempts have been made to find domestic deposits of pyrite that can be used if the supplies of foreign ore are curtailed under the conditions imposed by the war.

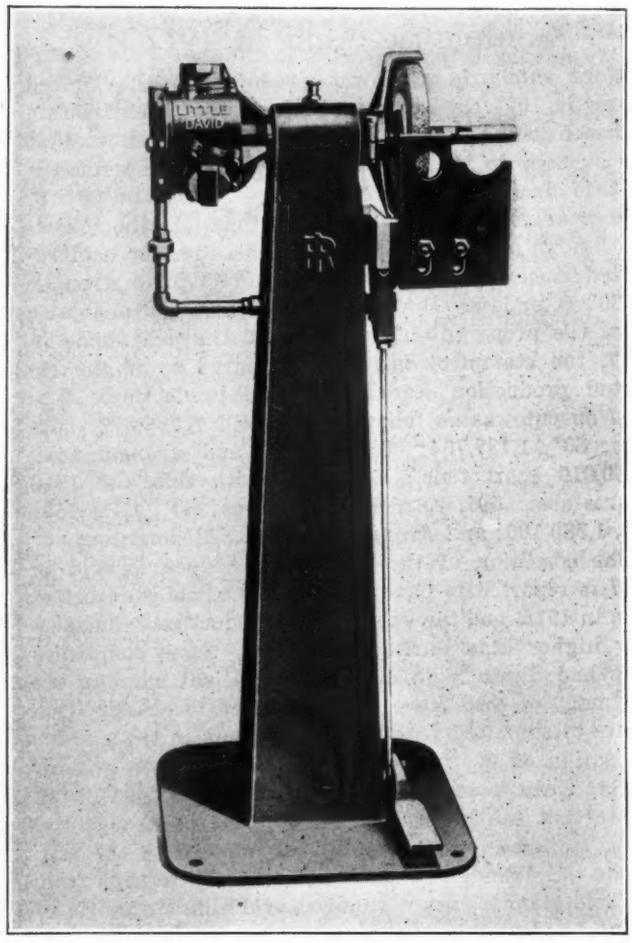
The estimates given above are based on returns from the acid manufacturers received by Philip S. Smith, of the Geological Survey. Nearly 98% of the manufacturers reported their production, and that of the others was estimated from previous records. It is believed that the totals of these preliminary figures will approximate closely the final figures, which will be made up when the complete returns are received, although the quantity of acids of different strengths, as stated, may require considerable readjustment.

Rates for Transporting Sulphuric Acid in tank cars from producing points in Utah to New York, Boston, Philadelphia and Baltimore will be canceled if the Interstate Commerce Commission grants permission to do so sought by the Wabash Railroad.

Mining and Metallurgical Machinery

A New Pedestal Grinder for the Drill Sharpening Shop

Adequate attention to the forming of bits and shanks on rock drill steels is in a large measure responsible for the attainment of better results from the drilling machines. Properly designed machine sharpeners forge both bits and shanks that are perfectly formed and accurately gaged, a punching machine enlarges the hole in hollow steels to its proper size so that there remains but one step in the preparation of the steel for drilling, the



GRINDER FOR DRILL SHARPENING SHOP

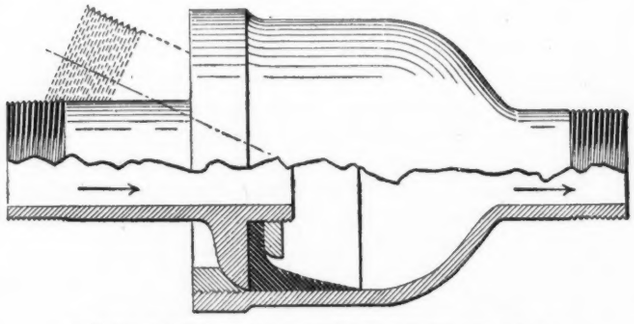
squaring off of the drill shank. Unless drill shanks are made square on the end, a strain is thrown on the hammer-drill piston and causes piston breakage, which is an expensive item, not only in the cost of part replacement but also in the time that the drilling machine is out of commission. Further, with imperfect shanks it is not possible to take advantage of the full force of the piston blow, and drilling speed is retarded.

To insure shank perfection, the Ingersoll-Rand Co. has developed the "Little David" pedestal grinder for shop use. This, like the sharpener and punching machine, is operated by compressed air. It is light in weight, readily portable and requires only a plank base. The powerful three-cylinder motor operates in a bath of oil and consumes little power. A single foot lever controls the machine, so that the blacksmith can use both hands to hold the steel. Ordinarily the grinding wheel used is of 8-in. diameter and 1-in. face. The spindle is fitted with a No. 2 Morse taper socket so that a rose reamer can be used for countersinking the hole in the end of the shank. This operation guards against cutting the water tube of the drilling machine.

The "Little David" grinder is also used to true up the edges of drill bits, point picks and grind other tools around the blacksmith shop. The complete machine weighs 195 lb., is 44⅝ in. high, and occupies a floor space 17 x 20⅜ in. It operates satisfactorily with air pressures of 60 to 100 lb. per square inch.

Useful Pipe-Line Device

A useful fitting for pipe lines has recently been devised, and is being offered for use on steam, air, water and other pipe lines. It has several functions, and possesses characteristics that will satisfy the requirements of each, consisting primarily of a cup-shaped end into which is fitted a movable, curved socket, fixed



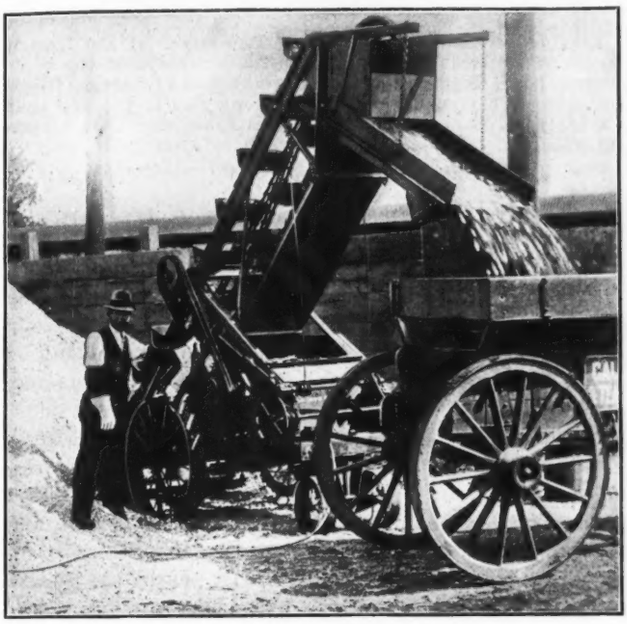
CROSS-SECTION OF BERRY FLEXIBLE JOINT

to the other end of the pipe where the desired joint is to be made.

The illustration shows the design of the fitting, known as the Berry flexible joint, and indicates its applicability for various functions. It has a ball-joint action, so that an angle may be readily formed, and acts also as an expansion joint, since the ball fits into the cup in such a way that it is free to move backward and forward, thus taking up the variations in lengths of the pipe due to temperature. The flexibility of the joint allows it to absorb vibrations satisfactorily, avoiding damage to the pipe from this source. The many uses of the fitting will be evident to the practical operator, and its convenience for the prompt changing of angles in a pipe line are such as to be self-evident. The device is manufactured by the Iron Clad Joint Co., of New Orleans, La.

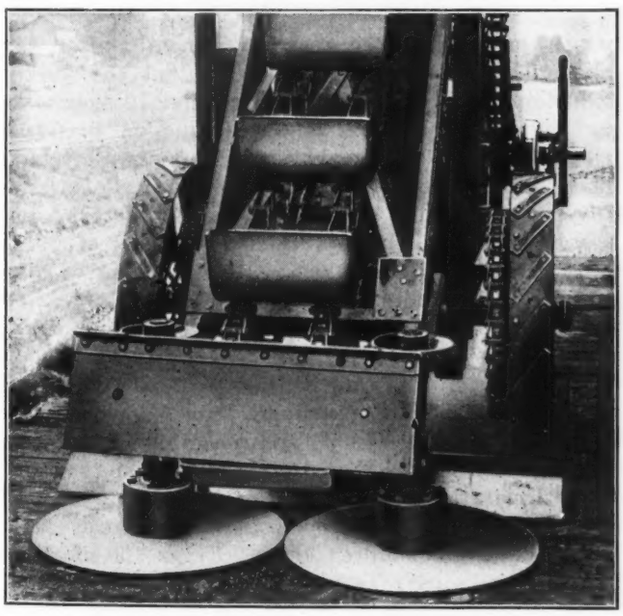
A Self-Feeding Bucket Loader

A machine that combines the features of the old wagon loader and the steam shovel has been placed on the market by the Barber-Greene Co., of Aurora, Ill., and is known as the B-G Self-Feeding Bucket Loader.



WAGON BUCKET LOADER IN OPERATION

The construction is heavy, making it suitable for handling loose material such as ore, sand, crushed rock, etc., of not larger than 6-in. diameter. The loading is done by means of a bucket elevator supplemented by a feeding device which consists of a pair of horizontal



DOUBLE-DISK FEEDING DEVICE ON BARBER-GREENE LOADER

disks set almost flat on the ground but with a slight pitch toward the pile. This double-disk feeder is at the base of the elevator, and as the disks rotate inward and toward the loading buckets, the material is carried toward the center, to be picked up by the buckets, which dig from the smooth surface of the disks. The disks enable the machine to dig a width of five feet rather than mere bucket width. The drive for the disks and the bucket is furnished by a 7½ or 10-hp. gasoline engine, with friction-clutch control, and a direct-gear drive to the rear wheels propels the loader forward or reverse, with two speeds in either direction. A differential gear provides for turning sharp corners. It is said the machine will handle 1 cu.yd. per minute.

Chart for Spacing Shaft Hangers*

The spacing interval for hangers on mill shafting depends upon the diameter of shaft, number and spacing of pulleys and the respective pulley loads. A calculation is simplified by the use of the chart illustrated.

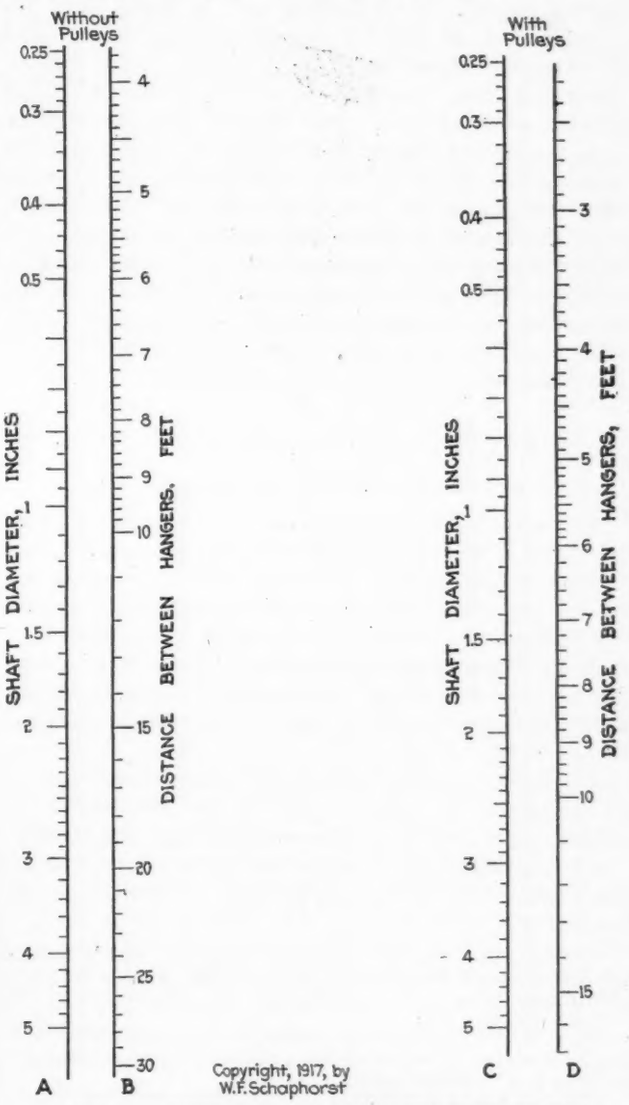


CHART FOR DETERMINATION OF SPACE INTERVAL FOR MILL SHAFT HANGERS

To determine the proper interval on a 2-in. shaft without intermediate pulleys, the diameter of the shaft, 2 in., is found in line *A* and the interval 15 ft. is read in line *B* horizontally opposite. Similarly to determine the interval on a shaft with intermediate pulleys the interval in feet is found on line *D* directly opposite the diameter of the shaft in inches on line *C*.

*W. F. Schaphorst, Mechanical engineer, New York.

Events and Economics of the War

The situation in Russia has been the focus of attention during the week. The Russians are reported to have signed a treaty of peace. Little resistance has been encountered by the Teutons. Kiev, capital of the Ukraine, has been reported occupied by German troops. The question of intervention by Japan in Siberia to protect her own and Allied interests is under discussion. President Wilson's principles have been called a "step toward peace" by Chancellor von Hertling, who demanded that the Allies subscribe to them; London and Washington regard him as insincere. In France, American troops repulsed an attack in the St. Mihiel salient, north of Toul. The Spanish cabinet resigned.

In the United States, April 6 was set as the date for opening the Third Liberty Loan campaign. Temporary changes in the food restrictions on "home cards" were announced by Food Administrator Hoover. The House passed the Administration's railroad bill unchanged. The bill for housing shipyard employees was signed by the President, who also approved an agreement made with producers of aluminum fixing the maximum base price of the metal at 32c. per lb.

Business Favors Economic Combination Against Germany

An overwhelming vote in favor of a resolution warning German business men that an economic combination will be formed against Germany after the war unless the danger of excessive armament is removed by making the German government a responsible instrument controlled by the people was announced by the U. S. Chamber of Commerce at the conclusion of a preliminary canvass of its organization members. The vote as recorded to date is 1204 to 154.

A referendum on the resolution was ordered on Jan. 12 and copies were sent to each of the 1000 local commercial and industrial organizations comprising the National Chamber. Each organization has from 1 to 10 votes, according to its membership. Following is the resolution:

Whereas, The size of Germany's present armament and her militaristic attitude have been due to the fact that her government is a military autocracy, not responsible to the German people; and,

Whereas, The size of the German armament after the war will be the measure of the greatness of the armament forced on all nations; and,

Whereas, Careful analysis of economic conditions shows that the size of Germany's future armament will fundamentally depend on her after-war receipts of raw materials and profits from her foreign trade; and,

Whereas, In our opinion, the American people for the purpose of preventing an excessive armament will assuredly enter an economic combination against Germany if governmental conditions in Germany make it necessary for self-defense; and,

Whereas, We believe the American people will not join in discrimination against German goods after the war if the danger of excessive armament has been removed by the fact that the German government has in reality become a responsible instrument controlled by the German people; therefore, be it

Resolved, That the Chamber of Commerce of the United States of America earnestly calls the attention of the business men of Germany to these conditions and urges them also to stop this situation and to coöperate, to the end that a disastrous economic war may be averted and that a lasting peace may be made more certain.

Federal Control of Roads to End Two Years After War

By a vote of 337 to 6 the House on Feb. 28 passed the Administration bill governing the operation of railroads under Federal control. As finally adopted, the bill is in the form reported by the Committee on Commerce, with the exception that it was amended to protect short lines, which amendment had been accepted by the committee. As passed the bill contains these chief provisions:

The President enjoys supreme rate-fixing powers, the authority of the Interstate Commerce Commission to fix rates being abrogated. The bill as it passed the Senate gave the President authority to initiate rates, but left the Interstate Commerce Commission with power to repeal the rates established by the President. The period of Federal control is fixed at not to exceed two years after the peace terms have been ratified.

Daily Rifle Output Over 13,000, Says Secretary Baker

Our weekly production of rifles 10 months after war was declared was four times as great as the weekly production of rifles in Great Britain after 10 months of war and twice as large as the production in Great Britain after two and one-half years of war, Secretary Baker recently declared. According to Mr. Baker, the daily rifle production by the Ordnance Department for the week ending Feb. 9, 1918, was: Model of 1917, 7,491; model of 1903, 1,086; Russian rifles, 4,435; Total, 13,012. Production for that week was 46,792 of the models of 1917 and 1903, and 24,400 of Russian rifles, or a total of 71,192.

Since Apr. 6, 1917, the Ordnance Department has manufactured and procured more than 700,000 of the service rifles, model of 1903 and model of 1917. This is 100,000 more rifles than were available at the time of our declaration of war. We have to-day a total of 1,300,000 service rifles. Only about 50% of troops carry rifles. We have in addition, 160,000 Krags, 100,000 Russian rifles, and some 20,000 Ross rifles, or a total of about 280,000 training rifles.

It is a matter of distinct military advantage that the parts of the new rifle are so standardized as to be interchangeable in the field. The model of 1917 has ballistic power involving a chamber pressure of about 51,000 lb., as compared with 42,000 lb. in the case of the British Enfield. The gun withstands the high pressure of the American ammunition on equal terms with the Spring-

field rifle, the barrel having been changed to possess the same strength, while the receiver and the bolt action are amply strong, since they are of 3½% tempered nickel steel, giving one of the strongest bolt actions of any gun. The new rifle takes a 30-caliber cartridge, which has the advantange over the British Enfield of being rimless.

To achieve the rifle and ammunition production program the Government has expended or has obligated itself to expend, during 10 months of war, $400,000,000, and some 200 officers, 80,000 men, and 10,000 women have been engaged exclusively in the manufacture of rifles and cartridges. Two Government plants and three privately owned plants are engaged in making rifles, and one Government plant and nine privately owned plants are engaged in cartridge manufacture. Ordnance experts in this country and in Europe are in agreement that the U. S. Army is being equipped with two of the best three rifles in the world.

War Savings Stamps a Good Investment

The "Limit Club" is a feature of the present national war-savings campaign. The principal idea of the club is that every individual who can possibly afford to take war-savings stamps to the limit allowed by law ($1000 at maturity, which cost only $826 in February, 1918, $828 in March, etc.) do so, in order to set an example to employees and others of lesser means and to show that the man with means feels that war-savings stamps are a most excellent investment.

There are two kinds of war-savings stamps—25c. "thrift" stamps and $5 stamps. The $5 stamps sell for $4.14 during March, 1918, and for 1c. additional each month thereafter during 1918. That is $4.15 in April, $4.16 in May. etc. The Government will pay $5 for each of these stamps in January, 1923.

The 25c. stamps sell at all times for 25c.—the price does not change. With the first 25c. thrift stamp bought at the post office, bank, etc., the purchaser is given a "thrift card" with spaces for 16 such stamps, or $4 worth. When the card is filled, it may be exchanged for a $5 stamp at the post office by the payment of 14c. in March, 1918, 15c. in April, and so on. Purchasers who wish to dispose of their stamps for any reason before January, 1923—the maturity date—may sell them back to the Government at the advanced current price, thus recovering the principal with interest.

Complaint of Dirty Coal Justified

In all the recent crises there has been no more justified complaint, the U. S. Fuel Administration has admitted, than that of the great quantity of unclean coal sent to the householder's bin. To be compelled to pay high prices for stone, slate, and dirt was an injustice, it was generally felt, and warranted loud protest. The Administration has already begun to remedy this abuse, and local inspectors have been stationed at the mines to inspect the entire output and see that the coal is clean.

Floyd W. Parsons, editor of *Coal Age*, after a talk with Dr. Garfield, said the Administration was determined to put through the plan for the elimination of jobbers.

"There is unanimity of determination at Washington," he said, "to do away entirely with coal speculation. Some jobbers will go out of business, but those having title to coal outputs will not. It is likely that some small operators will be glad to have certain jobbers finance and manage all coal sales. Local fuel administrators, however, when necessary, will be the link binding the producer and the consumer. Washington is aiming at 'mine to bin' service.

"A zone system will soon be put into operation to save transportation. The country will be divided into three grand divisions, Eastern, Central and Western. The Eastern will be supplied by the Allegheny fields. Roughly speaking, the Western limit of this Eastern zone will be the Ohio-Indiana line. All long hauls of Allegheny coals will be eliminated, but this coal will be permitted to reach the Northwest by way of the Lakes. Byproduct gas coals and smithing coals will be allowed out of their zone in special cases."

Iron and Steel Conditions Improve

The improvement in iron and steel works operations has gone further, as indicated by 75% blast-furnace operations at Steel Corporation plants, accompanied by 85% active ingot capacity and 80 to 85% in rolling mills, says *Iron Age* in its last issue. Some companies have not fared so well. Eastern Pennsylvania, which was hardest hit, is still short of coke, and blast furnaces there have scarcely exceeded a 50% operation, with steel works at 60% or less. Pittsburgh and nearby districts are suffering from new car shortages. Loaded cars have left the mills, but are not returning, and the giving of special priority to food shipments has resulted in the sending of empty cars all the way from the East to the Far West. Coke shortages increased.

Steel manufacturers conferred in New York on Mar. 1 preparatory to a meeting with Government representatives to consider the prices that will prevail after Apr. 1. Steel producers, after months of hamperings, with steadily advancing costs, now ask for stabilized prices over a period of six to nine months. The uncertainty as to prices and pig-iron and steel supply is beginning to affect consuming industries in a number of lines, and the next conference at Washington is considered of more moment than any that have preceded it.

Foundry operations have been curtailed here and there for lack of pig iron, but there are also cases in which the demand for castings has fallen off because certain industries in the less essential class have found their sales diminishing or have had to stop for lack of fuel. Inquiries recently before the market from Canadian shipyards have been withdrawn, and the needs of these yards, which are put at 300,000 tons for the year, will be supplied by American mills under Government arrangement, the distribution being made at Washington. At Toledo, Ohio, four vessels have been booked that will take about 10,000 tons of steel.

With more plates available for general use, demand is cropping up. Oil companies are now planning to add to their tank capacity, and from other directions feelers are being put out. At Cleveland an order for 13,000 tons of light plates for submarine fighters is one result of the new activity at Detroit.

The belief that even more ship plates can be rolled than will be needed at home is indicated by an offer of 3.75c. at mill on a large tonnage for export—considerably below what has been regarded as the export market price.

On some of the Japanese ship plates on which rollings were held up by the embargo last year credits have now run out. The proposed new placing of this business, amounting to many thousands of tons, at Government prices, as against 9c. and 10c. in the original contracts, is a factor in the negotiations between the two governments. It will bear in an important way on the prices the Government will pay for Japanese ships.

Fabricated steel business dropped to 95,000 tons in January, from the 205,000 ton total of December. When the rush for munitions plants had run its course in 1915, culminating in 208,500 tons of fabricated work in December of that year, the total for January, 1916, fell to 119,000 tons. The recent large lettings of fabricated steel for ships now leave little before the bridge and structural shops.

A proposal to tear up the rails of the Hudson Bay R.R. for war purposes abroad lends interest to an effort to sell some 65,000 tons of heavy rails, bought and paid for by what was once Russia, but still stored in this country. They may yet be turned to account for the Allies and the question of title settled afterward. France has bought 1500 forgings for 155-mm. guns and 250 for 75-mm. guns. The transaction is added evidence of her inadequate raw material supplies but of abundant gun-making facilities.

Mining and Smelting Companies Prosper in Germany

In a survey of German mining and smelting industries, made by the *Frankfurter Zeitung* and based on the reports of the various companies, stress is laid on the fact, says *Commerce Reports*, that all the works were busy to their utmost capacity, and that while army and navy orders still predominated the first evidence of interest in peace needs could be noted. It is stated that it has been impossible to furnish figures of output; but, in view of the enormously increased profits of the various companies, the output must have gone up by leaps and bounds. But for transportation difficulties and the shortage of skilled labor production would obviously have been even larger. The record profits of the companies, despite the fairly large sums set aside for war-profits taxes, were made possible by the good prices, which were more or less in accord with the enhanced cost of raw materials and the general higher out-of-pocket expenditure.

The results of 37 companies engaged in iron and steel production and coal mining, point to the conclusion that few other branches of industry in Germany have enjoyed more favorable conditions during the war period. Profits have reached records that leave the results of previous years far behind. Even so, it is questionable whether the published profits really represent the total gains of the several concerns; for on the one hand the amounts written off and put to reserve have been greatly increased in view of the war conditions, and on the other there must be large invisible reserves which do not appear in the balance sheets. This much at least is certain: that with the exception of two enterprises the companies specifically studied were able to show increased net profits and to raise their dividends to the peace level. Many even surpassed the peace level.

The concerns devoted exclusively to coal were unable to show increases in profits to the same extent as the iron and steel works, but their profits were nevertheless good. Mixed works likewise are able to look back on a profitable year, although the results of the companies in southwestern Germany could not compare with those of the Rhenish-Westphalian and Silesian works. This was partly because the southwestern concerns produce ores of a poorer quality and partly because their plants are near the war zone. Most prosperous of all were the iron and steel works, which, despite considerably increased sums written off and placed to reserve, were yet able to increase their net profits by 60,000,000 marks [at normal exchange the German mark is worth 23.8c.] and their dividends by an average of two per cent.

Platinum Commandeered

Orders were issued on Feb. 28 for the commandeering for war purposes of all crude and unworked platinum in the hands of importers, jobbers and wholesalers. Increasing need for platinum in the manufacture of munitions, according to officials, rendered this step imperative. Commandeering will be carried out through the War Department. The world supply of the metal is comparatively small, and production has shown a steady decline since the war began. Internal troubles in Russia have virtually eliminated the world's chief source of supply. The War Committee of the jewelry trade has been asked to ascertain how much platinum is now in the hands of manufacturing jewelers, and, if necessary, they will be asked to surrender it. There is no present intention of commandeering manufactured platinum, it is said.

A modern battlefield—one of those vast seas of interlapping shell holes—is strewn with wreckage of every sort. This debris is not only dangerous because of the explosives included, but is often of great military value. To remove the danger and realize the value, companies of old soldiers, territorials, have been formed who may be seen on the day after battle, bending over the tortured earth, exploring it in every direction. On the battlefields of one single army during a single month the material collected included 2000 tons of iron and steel, 32 tons of copper, 1,000,000 rifle cartridges, 2000 trench bombs, and 1048 rifles.

No "cost-plus" contracts will be let under Administration program for housing munition workers, Otto M. Eidlitz, Federal Director of Housing, assured the House Public Buildings Committee. "We shall do business on a fixed price," he said. "When that is impossible, there will be a stated compensation, beyond which the contractor will not be permitted to go. I am against the cost-plus system, although my firm now has hundreds of such Government contracts."

Remember the Comfort Fund of the 27th Engineers.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Mineral Information Board Organized

Formal organization of the Joint Information Board on Minerals and Their Derivatives has been effected. Pope Yeatman, who is in charge of non-ferrous minerals for the War Industries Board, is chairman of the new organization. Edson S. Bastin, of the U. S. Geological Survey, is the secretary of the board. The Joint Information Board is not intended to supplant or to supplement the work of existing Government agencies. The object is to make the work of each organization more useful to the other by keeping all informed as to what is going on in the way of mineral work, or, as George Otis Smith puts it, "Thus avoiding doing things twice or half doing them."

The board intends to build up files of information on all the principal minerals. A record will be kept showing in detail all mineral activities being conducted by or for the Government. The board will meet three times each week until plans have been perfected for the coördination of the work. The membership of the board is as follows:

A. B. Adams, Treasury Department, Internal Revenue; H. R. Aldrich, War Industries Board, Division of Statistics; Edson S. Bastin, U. S. Geological Survey; Frederick W. Brown, Department of Agriculture, Bureau of Soils; R. M. Chapin, Department of Agriculture, Bureau of Animal Industry; Melvin T. Copeland, War Industries Board, Commercial Economy Board; Thomas Cox, U. S. Fuel Administration, Oil Division; Frederick P. Dewey, Treasury Department, Bureau of the Mint; H. A. Havens, Department of State, Consular Service; John K. Haywood, Department of Agriculture, chairman, Federal Insecticide and Fungicide Board; Commander R. S. Holmes, Navy Department, Bureau of Ordnance; C. C. Houghton, Federal Trade Commission; Henry Hubbard, Department of Commerce, Bureau of Standards; Lincoln Hutchinson, War Trade Board, Bureau of Imports; Karl F. Kellerman, Department of Agriculture, Bureau of Plant Industry; Lieut. Col. R. P. Lamont, War Department, Ordnance Dept., U. S. Army; C. K. Leith, U. S. Shipping Board; C. E. Lesher, U. S. Fuel Administration, Statistical Dept., Coal Division; Chas. W. Merrill, U. S. Food Administration, Division of Chemicals; Harvey S. Mudd, Bureau of Mines; Lieut. Comm. N. W. Pickering, U. S. Navy, Bureau of Ordnance; G. F. Richardson, Office of Director Gen. of Railroads, Car Service Division; Guy C. Riddell, U. S. Tariff Commission; S. H. Salomon, War Trade Board, Bureau of Research; C. D. Snow, Department of Commerce, Bureau of Foreign and Domestic Commerce; J. E. Spurr, U. S. Shipping Board; L. L. Summers, War Industries Board, Division of Raw Materials; F. G. Tryon, War Industries Board, Division of Statistics; F. P. Veitch Department of Agriculture; Pope Yeatman.

Bureau of Mines Wants Quarter Million for War Minerals Work

Appropriations totaling $250,000 have been asked by the U. S. Bureau of Mines for special investigations of war minerals. In a letter transmitted to Congress, F. S. Peabody, as acting director of the Bureau of Mines, points out the necessity for these as follows:

"I believe that the investigations outlined are of such importance and urgent necessity that every effort should be made to have them undertaken immediately. I am constantly receiving requests from the various military bureaus and official boards of the Government for technical information along these lines which is necessary to solve the problems which confront them. If this work is to be effective, it must be organized and undertaken immediately."

It is proposed to divide the appropriation as follows:

Manganese	$80,000	Antimony	$10,000
Pyrites and sulphur	35,000	Chromite	15,000
Sulphuric acid	25,000	Magnesite	5,000
Graphite	20,000	Mica	3,000
Tin	15,000	General expenses	20,000
Mercury	5,000		
Potash	10,000	Total	$250,000
Tungsten	7,000		

Manganese

Experiment and demonstration to extend the use of spiegeleisen and manganiferous pig iron to replace ferro	$40,000
Production of silico and ferroalloys in the electric furnace	5,000
Treatment of rhodochrosite	5,000
Analysis of manganese specifications for steel	5,000
Substitutes for manganese in steel manufacture	5,000
Field parties to examine and sample ore deposits	10,000
Concentration of low-grade ores	10,000
	$80,000

Pyrites and Sulphur

District engineers to supervise and stimulate pyrite production	$15,000
Preparation and use of pyrite from coal mines	8,000
Utilization of pyrite cinder, including the recovery of copper	3,000
Use of pyrrhotite	3,000
The treatment of sulphur, including flotation as applied to surface deposits in the West	3,000
Reduction of sulphur used for wood pulp (sulphate wood pulp)	3,000
	$35,000

Sulphuric Acid

Increasing the efficiency of chamber plants	$5,000
Investigation of the possible reduction in the consumption of acid	5,000
Recovery of sulphuric acid in the manufacture of high explosives, oil refining, pickling iron and steel, and utilization of "niter" cake from explosives plants	5,000
Use of enriched air or oxygen in manufacture of acid and use of liquid SO_2	5,000
Concentration of chamber acid	5,000
	$25,000

Graphite

Improvement in milling practice, including flotation and electrostatic separation of mica and improvement of health conditions	$8,000
Domestic graphite for crucibles compared with foreign materials—Use of low-grade flake—Use of suitable domestic clays—Standardization of domestic product	5,000
Utilization of amorphous and low-grade graphite, including possible manufacture into artificial flake	5,000
Substitution of electric furnace steel for crucible steel, thereby eliminating crucibles	2,000
	$20,000

Tin

Recovery of waste tin	$15,000

Mercury

Concentration of low-grade ores—Improvement furnace practice	$2,000
Uses and substitutes for mercury, particularly for fulminate	3,000
	$5,000

Potash

Potash survey—Recovery from cement kilns and blast furnaces—Alunite, leucite, feldspar, brines, and mine tailings	$10,000

Tungsten

Improved methods and reduction in losses in milling of ores and manufacture of ferro	$5,000
Properties and use of molybdenum as substituted for tungsten	5,000
	$10,000

Antimony

Substitute for antimony for hardening lead (calcium, barium, and lead)	$4,000
Domestic versus Chinese antimony when used as antimony sulphide for primers and small-arm munition	3,000
	$7,000

Chromite

Field examinations	$5,000
Concentration of low-grade ores for ferrochrome and refractories, and use of low-grade ore for salts	5,000
Substitutes for chromite for refractories (magnesite) and for ferro	5,000
	$15,000

Magnesite

Addition of iron to domestic product for refractories—Preparation—Experience in use—Permanent market	$5,000

Mica

Standardization of mine product—Properties of domestic mica as compared to imported product	$3,000

Production Must Be Balanced

By H. L. Gantt

There are indications that we are approaching an industrial and economic crisis, one of the most significant signs being the amount of criticism which is showered on those in charge of Government activities, nearly all of which at present relate to the war. Attempts to place individual responsibility for various inefficiencies are made on all sides, and it is only natural in this confusion that Army officers and Government officials in general should be the first to receive the blow, for we have always held the theory that Government officials were far more inefficient than our business men.

The number of applications from private manufacturers for the help of "efficiency engineers," which has so largely increased lately, is indicative of a realization on the part of many of our manufacturers that their methods also are not what they should be. The people who are applying for help are in many cases no worse off, as far as their methods are concerned, than others who have not yet discovered how badly they are doing their work. The whole subject seems to resolve itself into the fact that our business and industrial systems are not suited for times like these, when it is necessary to combine all our energies and exert our full driving power toward the achievement of one supreme object.

We should not be surprised that this is the case, for our economic theory has never contemplated teaming up all the industries of this country for one object, but has rather discouraged that idea and encouraged individual competition of the most strenuous kind. In other words, we are a nation of individualists who have never really seriously contemplated coöperation for the common good.

When this problem of coöperation is suddenly put up to us, as it has been by the war, it is not surprising that our business men, trained in the individualistic school, should be entirely unfitted to solve the new problem. Moreover, it might be expected that the men who have been most successful in individualistic, competitive business, in which profit was the main aim, should be actually the ones least fitted to establish a scheme of business and production for the benefit of the community. This is a new problem to them, and one altogether outside their experience.

It is to be granted that such business men may have individually great driving power, but this very excess of driving power in individuals or corporations is likely to make the confusion all the worse, unless a means of coördination is established which will keep the driving power of the individuals or corporations in proper balance.

It has become perfectly evident to all observers that the capacity of the nation for production of war material is enormously greater than its capacity for shipping it to Europe, and that we must at once not only balance this production, but slow it down in order to prevent such a choking of our Eastern ports as may produce an impossible and dangerous condition. The five-day shut-down ordered by the Fuel Administrator and the one day per week shut-down are our first attempts to slow up this production, and we ask ourselves at once if this is the best way. The answer comes that if we are making too much war material we had better turn some of our activities into the manufacture of articles of peace. Immediately we run into the financial situation, which at present seems to seriously hamper new undertakings.

It would seem that the claim of the railroads that they need $1,000,000,000 worth of improvements should at this juncture be considered. Here is one organization, now devoted exclusively to the service of the community, which, being under the control of the Federal Government, can be financed directly by that Government, and there would seem no reason why the production programs of war material should not be limited, and a certain amount of the energy now being expended in that direction turned at once toward improvement of our transportation facilities.

This is the first suggestion that occurs to one as a means of avoiding the economic situation which seems to be forcing itself upon us. If we can afford to spend billions for war, should not our Government be authorized at once to turn whatever surplus energy has been inadvisedly called into this work into channels that will benefit the community in time of peace?

After nine months of confusion, it is becoming perfectly clear that as far as we are concerned, in this country at least, our war problem is one of production and transportation on a huge scale. The critical point today is recognized on all sides to be our ability to transport material to Europe. We have in the past repeatedly had estimates as to what transportation facilities we should have, but it is only recently that any real attempt has been made to study the transportation problem thoroughly and to find out what the limiting factors were and how they could be improved. It is hoped that through the investigation which is now being made, we shall shortly have exact knowledge on this subject. In the meantime, however, we already have approximate knowledge which indicates that our production of war material is rapidly outrunning the possibilities of transportation.

Early in December Dean Schneider, working for the Ordnance Department of the Army in Washington, warned General Wheeler, Acting Chief of Ordnance, of the situation which is now impending, and the Ordnance Department began promptly to investigate. Investigations of this subject by one department, however, are not sufficient. Our whole production program must be harmonized with the possibilities of over-seas transportation. In other words, an attempt should be made at once to balance our production of war material of all classes with the possibilities of transportation, and wherever necessary the production program should be slowed down at once in order that the congestion on our Atlantic seaboard may be relieved. The slowing down of this program means that energies which have been unwisely directed to war activities must be at once transferred back again to the industrial work which has to do with peace and the upkeep of our industrial organization.

This is necessary for two reasons:

First: If we are going to spend fifteen billions per year in war, we must produce at least fifteen billions more material than we need for peace times, which means that our working plant must be kept in the best possible condition.

Second: If we do not realize that by the production of a surplus of war material we shall ultimately be compelled to cease that kind of manufacture and thereby suddenly throw out of work numbers of men, we may precipitate an economic crisis of great magnitude.

Manganese at Piracaua, Brazil

WASHINGTON CORRESPONDENCE

Much importance is attached to the manganese deposits at Piracaua, in northern Brazil, by U. S. Consul George H. Pickerell, stationed at Para, Brazil. He quotes extensively from a report on this property. The Department of Commerce considered the matter of sufficient importance to devote more than two pages of *Commerce Reports* of Feb. 8 to this subject. A summary of the engineer's report is as follows:

1. There exists a formation of manganese that crosses the property from east to west.
2. It is calculated that the "Deus to Ajuda Hill" alone contains at least 300,000 tons of high-grade manganese ore, which can be mined by simple adits; that the cost of delivering the ore on board ship in Piracaua Harbor need not exceed $2 a ton.
3. The means of access to the property are excellent, as there is a harbor 4½ miles distant from the "Deus to Ajuda" accessible for vessels up to 25 ft. draft.
4. The climate is healthful.
5. Supplies and labor are to be had very cheaply.
6. Timber and fuel exist in more than sufficient quantities for any purpose.
7. The ore from Piracaua can be delivered on shipboard $3 more cheaply than ore from the biggest Brazilian mines, and consequently manganese can be worked on Piracaua at a profit when ore from other Brazilian mines would only pay expenses.
8. Piracaua is the best located of the known manganese mines.

Comfort Fund to the Rescue

All out of smoke, and pay day a long way off—a bad state of affairs, as even the censor will admit. Meatless and wheatless days can be endured, but days when the tobacco pouch is empty are certainly fierce. The S O S relayed to us from camp, where some of the Twenty-seventh were in this condition, found a state of preparedness, thanks to the Comfort Fund, and the matter was immediately adjusted without any red tape. One of the advantages of the fund is the speed with which such matters can be attended to. It is like the games in the "Streets of Cairo" where you ring a bell and get a good cigar. In fact, in the present case, it was through the aid of the great Fatima that the sorrow of the boys in camp was alleviated.

"Out of tobacco" means a great deal—a really serious condition. We recommend to smokers who are interested in the mining regiment—and that should include all mining men—that they consider the following fifty-fifty proposition: Send the Association of the 27th Engineers monthly, or whenever you wish, as much as you spend on tobacco for yourself; in other words, as often as you light up, set one up for some fellow in the mining regiment. That will help keep the fund up (there will be a constant drain on it) and it will keep you in touch with the mining regiment through this column, as you ought to be. And if you want to contribute more than that amount, go as far as you like. Remember this: every cent is to be spent directly on the men in the regiment or upon their dependents—there is no administration expense. The list of contributers to date is as follows:

Engineering and Mining Journal	$1000.00
New York Engineering Co.	1000.00
A Friend, Nov. 23	5.00
H. H.	5.00
D. E. Charlton	5.00
H. W. Hardinge	1000.00
Frank N. Spencer	5.00
W. L. Coursen	5.00
J. H. Polhemus	5.00
J. H. Janeway	10.00
Albert D. Beers	10.00
J. E. Hayes	10.00
J. A. Van Mater	25.00
L. Vogelstein & Co.	100.00
"Cuprite"	10.00
R. H. Bassett (Hanna Ore Mining Co.)	10.00
A Friend, Dec. 10	10.00
P. A. Mosman	10.00
American Zinc, Lead and Smelting Co.	100.00
J. G. H.	5.00
Daniel Guggenheim	100.00
A. H. H.	5.00
Willard S. Morse	25.00
August Heckscher	100.00
Anaconda Copper Mining Co.	1000.00
F. W. Bradley	100.00
Charles Le Vasseur	5.00
A Friend, Dec. 13	50.00
Freeland Jewett	10.00
Herman A. Wagner	5.00
Francis P. Sinn	10.00
R. C. Gosrow	5.00
D. C. Jackling	100.00
"V"	10.00
J. H. Brickenstein	5.00
E. E. Northrup	5.00
Rogers, Mayer & Ball	50.00
Denver Technical Staff, American Metal Co., Ltd.	30.00
A Friend, Jan. 9	100.00
E. B. Coolidge	10.00
J. V. N. Dorr	200.00
Pope Yeatman	50.00
W. H. Aldridge	50.00
C. E. Hart	5.00
Robert I. Kerr	5.00
Engineers of Washoe Smeltery, Anaconda Copper Mining Company	205.00
Harry C. Graham	25.00
Utah Copper, Nevada Consolidated, Ray Consolidated and Chino copper companies	1000.00
A Friend, Jan. 23	5.00
John Gillie	25.00
J. N. Houser	5.00
C. K. Lipman	50.00
Theodore Sternfeld	50.00
Clinton H. Crane	500.00
T. Wolfson	10.00
William H. Hampton	10.00
W. E. Merriss	10.00
J. Parke Channing	100.00
Miami Copper Co.	250.00
J. H. Means	10.00
C. W. Goodale	25.00
P. G. Beckett	50.00
F. R. Foraker	25.00
Charles A. Chase	25.00
E. Fleming L'Engle	5.00
Calumet & Hecla Mining Co.	250.00
H. G. Ferguson	18.00
Jay E. Van Gundy	10.00
Franklin Osborn	10.00
Oscar Lachmund	10.00
W. T. Swoyer	10.00
Interest	10.00
Quincy Mining Co.	100.00
American Metal Co.	250.00
William H. Fairbanks	25.00
D. E. Curry	5.00
W. R. Ingalls	50.00
H. A. Guess	25.00
J. Mc. C.	5.00
Engineers' Club of Northern Minnesota	85.00
B. B. Thayer	50.00
R. H. Sales	25.00
Albert C. Burrage	100.00
Edward H. Clark	25.00
P. Rutherford	5.00
Adolph J. Martinson	2.00
Frank R. Edwards	5.00
C. H. Munro	100.00
E. E. McCarthy	25.00
J. L. Bruce	15.00
D. Ford McCormick	10.00
Louis D. Huntoon	5.00
P. G. Spilsbury	10.00
Total	$8990.00

The mining regiment needs recruits; help to get them. If you cannot enlist yourself, subscribe to the Comfort Fund. Make your check payable to W. R. Ingalls, treasurer. In view of the considerable detail work in the administration of this fund, acknowledgment of contributions is made only through publication in the *Journal*.

Editorials

Essentials and Non-Essentials

THE matter of economic importance that is now engaging minds in Washington is the proscription of what are called non-essential industries, but even in the highest quarters of the Administration there is difference of opinion respecting the new molestation of industrial affairs that is proposed. Nor is there any agreement regarding facts, which is naturally the first thing that should be settled.

There is, moreover, a certain glib carelessness about the phrase "non-essential industries" that is apt to lead us into trouble if there be not clear thinking about the problem. There is, indeed, much doubt as to whether many industries are non-essential; and, furthermore, whether the suspension of some of those that are distinctly non-essential would be wise. For example, we suppose that the manufacture of feathers for the trimming of women's hats might reasonably be classed as a non-essential industry, but to forbid it would be likely to throw out of employment a class of people unsuited for other work, whose idleness would be a burden outweighing any saving of coal and transportation that could be expected.

Again, industry such as the promotion of shady financial enterprises, consuming paper, clerical and printing labor, use of the mails, etc., may not only be non-essential but also vicious; yet its eradication might not be worth the trouble, at this juncture.

But in the main, the interrelation of industries is such that branches that at first sight appear to be non-essential exhibit themselves in a different way when considered carefully. Thus, the jewelers of Attleboro may be regarded as cluttering up our path in winning the war, for soldiers do not need jewelry, but if they were to be shut up we should deprive ourselves of their ability to make parts for certain necessary scientific instruments. And, moreover, while it is true that soldiers and sailors do not need jewelry, we use such wares to pay in foreign countries for things that must be bought and imported for military use.

The phrase "eliminate the non-essentials" is a derivative from the sound theory enunciated early in the war to "increase production and curtail consumption." By curtailing consumption was meant above all things the diminishing of wastes. This is a sterling teaching of economics. Manifestly the public welfare is increased by reducing the fire loss, the depredations by vermin, the careless throwing of useful things into the garbage pails and scrap heaps. We may properly take further steps. We may reduce our eating, following the illuminating showing of Hoover that we eat too much. We may get more wear out of our clothing before we discard it. Finally, we may dispense with luxuries, such as pleasure touring in automobiles. Contributory to the effecting of these desirable economies are natural law, exhortation, and proscription, which ought to function in the order here stated. The natural law will in itself bring about all possible economies by making them compulsory, and the adjustment of industry to the new conditions is then automatic. We have a classic example in the swift reduction in the consumption of lead for bird-shot when the price for lead rose extravagantly in 1917.

But the economic policy of the Administration has been based on the theory of suspending the natural law, and consequently the main reliance has had to be on exhortation, which ought to be supplementary, not primary. Even in foodstuffs there is ground for the belief that more freedom in the markets, supplemented by the admirable propaganda of the Food Administration, would have been more effective in curtailing consumption. The third expedient—proscription—is dangerous, although it is not outrightly to be condemned. Thus, the forbidding of the traditional American Fourth-of-July, with wastes that are not only profligate but also are dangerous, would be of incontestable merit. The prohibition of the use of grain in brewing and distilling may be supported on economic grounds in time of peace as well as in war. But the damage that may follow the general proscription of industries was well illustrated by the results of Dr. Garfield's recent coal order.

In the matter of eliminating or suspending non-essentials, there should be a careful discrimination between production and consumption. There is unfortunately a confusion of thought in Washington on this subject. When it is remarked that "We are at war and we cannot have business as usual," there is utterance of a truism; but this does not mean the following of happy thoughts that this, that or some other kind of production is non-essential and therefore is summarily to be forbidden by the deprivation of coal supply or otherwise. Rather does it mean that the public should reduce or suspend its *uses*, either for the reason that they are wastes that may permanently be reduced, or that they are for things they may be postponed. The subjects of wastes we have touched upon already. With regard to things that are not wastes but may desirably be postponed: The householder may be moved to refurnish his house, but it is not too much to ask him to make the old furniture suffice for a while longer. Similarly as to building by individuals, many municipal improvements, etc. The surest way of compelling this is high costs, and in fact just that thing has been compelling it. Patriotic exhortation (and also exaltation) is a valuable supplementary motive among the wealthy, who are able to ignore the increased costs. Let the curtailment of non-essentials follow these lines, and the matter of production will take care of itself, and there will be no arbitrary, ill-considered disturbance of industry.

Now, there arises the question whether, even while the curtailment of what is supposed to be non-essential

production is being meditated in Washington, the curtailment of consumption has not been already overdone? Let us examine some unexceptionable premises and also some facts.

Our business turnover in 1917 is estimated at about 50 billion dollars. This was effected with about 40 million workers. We enter 1918 with about two million subtracted for military service. This does not necessarily imply such a reduction in the capacity for production, for the military subtraction may be fully offset by the addition to the producers of some of those persons who previously had been habitually idle and some of those engaged in non-productive occupations. The mutually offsetting factors of decreased efficiency of laborers and increased efficiency of administrators, of increased output per man and simultaneously increased inferiority of product (as in the case of coal) cannot be correctly weighed; anyhow, not yet. Nor can we safely draw too close the analogies from British experience, for the British started with an industrial organization much inferior to ours. Allowing for that, however, and directing our attention to minerals and metals, we see from the British statistics that although Great Britain has sent a far larger proportion of her workers to the front, she has been able to maintain her production of coal and iron pretty well, her greatest reductions having been in building material. It is not therefore far-fetched to forecast that even with our military subtraction of men we can at least maintain our aggregate production of things and our business turnover. Nay, more: we ought to increase our production of iron, copper, lead, coal and other essential commodities, at the expense of stone, brick, cement and other building materials, and probably would do so if those industries were unhampered by Governmental regulations.

At present we are spending at the rate of about seven billion dollars per annum on our own war work and six billion for our Allies. The latter is not much of a dislocation of our industries, for previous to our entry into the war their purchases in this country approached that figure. The war work for them does not materially change the nature of our gross business from what it was in 1916, although the terms of payment are different, i.e. we are appropriating more of our net earnings to carrying them. But our own war work is, of course, a direct shift of industry, i.e. we have to transfer about 14% of our total turnover from one kind of work to another. Considering special industries, such as iron and copper, the percentage of diversion is, of course, much larger, but the very fact that it is so much larger must lead us to consider whether we have not already put into some branches of our war work too much of our energy (with not enough in other branches) and whether we have not too much curtailed what have been deemed to be non-essentials, not meaning that we have been excessive in eliminating wastes but that we have postponed internal improvements that ought not to have been postponed.

In other words, there is strong ground for the suspicion that the Government, to use a commercial phrase, has overbought itself in iron, copper, lead and other commodities, stocking up at various points with supplies that cannot be used for a much longer time than ordinary commercial prudence dictates the provision; and that the time will come when the Government will perforce cease buying and when ordinary business has been so crippled by the excision of what doctrinaires deem to be non-essentials that it will not be in a position to buy anything. This idea is lurking in the minds of the producers of iron, copper and lead as being a very real danger. Before any radical step is taken in Washington with respect to "non-essentials" we beseech the most prayerful consideration of this economic situation by whatever central powers there are to consider such things. There being no general staff, we do not know to whom to appeal.

We make, however, the representations that our economic troubles have not been due to too much manufacturing, for we did not in 1917 produce enough of the basic commodities to permit of increased manufacturing in the aggregate. Nor have they been due to a general and sudden outgrowing of railway capacity, for the railways carried the production in 1916, they had no more to carry in 1917 (except some millions of tons of slate and dirt in the coal), and they increased enormously their performance in the first six months after the railway board assumed direction of operations. Nay, the economic troubles have been due to the Government itself overbuying and congesting a relatively few places and a relatively few railway lines with goods that cannot possibly be used until 1919 or later. This followed from there being an entire absence of any munitioning and military plan. And now, in order to get out of the mess of its own making, Washington is meditating another shock to industry under the guise of proscribing non-essentials. Before that step be taken, there should be developed a plan, and there should be a stock-taking of what has already been acquired and contracted for.

"Business men and wage earners cannot lend money to the Government unless they can make it, and business must earn more money this year than last year." says Mr. Sabin, president of the Guaranty Trust Co. "There must be discrimination, of course, between that which is essential and that which is non-essential. But no legitimate business which can make money without competing with the Government is non-essential. In fact, it is very essential, because money is one of the most important munitions of war."

National Economics

IN 1911 that eminent British economist Sir George Paish estimated the annual saving of the American people at $5,000,000,000, of which about $2,000,000,000 was reinvested in means of housing the increase in population and about $1,100,000,000 for railway, tramway and municipal improvements.

The following statistics, collected from various sources, will aid in giving a perspective view of the present economic situation.

Finance:

Wealth of the United States at end of 1917, $250,000,000,000.

Estimated total income of the people, 1917, $50,000,000,000.

Estimated net income in 1917, $15,000,000,000.

Estimated net income in 1914, $6,000,000,000.

The above figures are quoted on the authority of eminent bankers, but in the nature of things they can be nothing more than very rough estimates. We are disposed to think that the net income in 1917 may be put too high. However, the increase in banking power reported by the Controller of the Currency shows that there was a very great increase in the wealth of the country in 1917.

Banking power at end of 1916, $29,353,500,000.
Banking power at end of 1917, $34,473,100,000.

By banking power is meant the total for capital, surplus, undivided profits, circulation and deposits of the banks of the nation. Although this is the official interpretation, its accuracy is disputed by some bankers.

Included in the total wealth of the United States is the following:

Total issue of railway securities, $20,000,000,000.

According to Secretary McAdoo, banks and fiduciary institutions hold $4,000,000,000 of these.

Of the gross income in 1917 a part was derived as follows:

Product of farms, $21,000,000,000.
Product of mines, $4,000,000,000.
Railway operating revenues, $3,492,516,961.

Of the total net income in 1917:

Railway net earnings, $958,000,000.

According to the Bureau of Internal Revenue, the net earnings of all corporations in 1916 amounted to $8,693,000,000. Considering this figure, the estimate of $15,000,000,000 as the net income of the people in 1917 is not incomprehensible. The increased saving power of the American people by ordinary economies is estimated at $5,000,000,000 by the *Wall Street Journal*. Our wastes are so great that the increased savings may easily be made more than that.

Annual avoidable food waste in United States, $1,000,000,000 (Hoover's estimate).

The banking power of $34,473,100,000 at the end of 1917 includes:

Money in circulation, Feb. 1, 1918, $4,965,878,604.
Gold held by Federal Reserve Banks, Jan. 31, 1918, $1,784,307,000.
Total gold in the United States, $3,000,000,000.

These resources permit possible additional credit expansion of $15,000,000,000 (according to Sir Edward Holden's calculation on present gold and cash holdings.)

Currency habitually carried in the pockets of American people, $1,500,000,000 to $2,000,000,000 (according to James J. Phelan, of Hornblower & Weeks).
United States public debt, Dec. 31, 1917, $6,664,359,097.
Europe's purchases from the United States in 1917, $4,054,362,029.

War Costs:

Great Britain's war cost up to Jan. 1, 1918, $32,800,000,000.
France's war cost, $15,400,000,000.
Italy's war cost, $6,000,000,000.
Germany's war cost, $26,600,000,000.
Austria-Hungary's war cost, $16,800,000,000.

The above estimates are of French origin.

United States military expenditures, July 1 to Dec. 31, 1917, $1,762,000,000.
United States naval expenditures, July 1 to Dec. 31, 1917, $550,936,000.
United States shipbuilding expenditures, July 1 to Dec. 31, 1917, $169,922,000.
United States total expenditures, July 1 to Dec. 31, 1917, $2,417,508,000.
United States total expenditures, July 1 to Jan. 31, 1918, $3,132,810,000.
United States loans to Allies, July 1 to Jan. 31, 1918, $3,143,348,000.
United States war expense, first 10 months, $7,100,000,000.
United States loans to Allies, first 10 months, $4,121,000,000.
France, total expenditures, 1917, $8,969,400,000.

The loans of the United States to the Allies are being spent mainly in this country. Our war cost of $7,100,000,000 in 1917, including the foreign loans, was about 14% of the total business turnover and about one half of our estimated net income. Not all of the military expenditure is destructive, a considerable part being applied for permanent improvements, such as increase in shipping capacity.

Estimate in 1917 of first year's war cost, $12,500,000,000.
Present estimate of first year's war cost, $7,000,000,000.
Present monthly expense, $725,000,000.
Estimate in 1917 of first year's loans to Allies, $6,000,000,000.
Present estimate of first year's loans to Allies, $6,300,000,000.
Present estimate of first year's cost and loans, $13,300,000,000.
Estimated receipts from internal revenue taxes, $2,800,000,000.

Railways:

Gross income of American railways, 1917, $4,038,000,000.
Net income of American railways, 1917, $958,000,000.
Guaranteed net income for railways, 1918 *et seq.*, $955,000,000.
American securities maturing in 1918, $741,631,853 (Lorœ).
Number of freight cars in the United States, 2,500,000.

Labor:

Total labor power of United States, 40,100,000.
Women engaged in mechanical and manufacturing industries, 2,000,000.
Women engaged in other gainful occupations, 6,750,000
Men required for the National Army, 1,700,000.
Available masculine labor power of the United States. 29,650,000.
Men engaged in agriculture, forestry and animal husbandry, 11,000,000.
Women engaged in agriculture, forestry and animal husbandry, 2,000,000.
Men engaged in mining, 1,000,000.
Men engaged in manufacturing industries, 9,000,000.
Women engaged in manufacturing industries, 2,000,000
Men engaged in transportation, 2,600,000.
Women engaged in transportation, 200,000.
Men engaged in merchandising, 3,400,000.
Women engaged in merchandising, 600,000.
Men engaged in public service, 550,000.
Women engaged in public service, 50,000.
Men engaged in professional occupations, 1,000,000.
Women engaged in professional occupations, 70,000.
Men engaged in domestic and personal service, 1,500,000
Women engaged in domestic and personal service, 2,500,000.
Men engaged in clerical work, 1,300,000.
Women engaged in clerical work, 700,000.

The above estimates respecting labor are according to a survey recently made by the Public Service Reserve of the Department of Labor. The same authority estimates that 225,000 men will be needed in France in staff corps work for each 1,000,000 of fighting men or men in the line. This means that one man behind the lines will be required to care for the needs of each four fighting men. For the most part they must be skilled men—engineers, building trades mechanics, machinists and blacksmiths.

Membership in American Federation of Labor, 2,371,434.

Shipping:

World's shipping capacity in 1914, 49,000,000 tons.

World's shipping at end of 1917, 42,000,000 tons (according to Captain Persius, German naval writer).

Other authorities estimate that the present tonnage is 4,400,000 less than at the beginning of the war and that the existing shortage is about 7,500,000. Add to this 3,000,000 tons as the minimum necessary to maintain 1,500,000 men in France.

Total net loss of ships during war, to Jan. 1, 1918, 6,617,000 tons.

Great Britain's shipping, Aug. 1, 1914, 16,841,919 tons.

Great Britain's shipping loss, 1916, 2,225,000 tons.

Great Britain's shipping loss, 1917, 5,000,000 tons.

Great Britain's shipping loss, 1914 to 1917, 9,116,915 tons.

Great Britain's construction and purchases, 1914 to 1917, 6,366,914 tons.

Great Britain's construction, 1917, 1,163,474 tons (official).

Great Britain's net loss, 1914 to 1917, 2,750,000 tons.

United States ships in process of construction, Aug. 3, 1917, 2,800,000 tons.

United States ships contracted under new program, 3,124,000 tons.

United States construction, 1917, 901,223 tons.

Great Britain-American construction combined, 1917, 2,064,697 tons.

Submarine sinkings, 1917, 6,000,000 tons.

Estimated American production, 1918, 3,000,000 tons.

Estimated British production, 1918, 2,000,000 tons.

United States Merchant Marine, Jan. 1, 1917, 12,250,000 tons.

Electrification:

Coal used by steam railways, 1917, 150,000,000 tons.

Coal saving by general electrification, 100,000,000 tons.

Oil saving by general electrification, 40,000,000 barrels.

Horsepower available for railway electrification, 25,000,000.

Total horsepower wasted in American streams, 35,000,000.

E. W. Rice, Jr., is the authority for the above figures.

Coal used in Great Britain per annum for power, 80,000,000 tons.

Estimated saving by electrification, 55,000,000 tons.

The above figures are from a report by the sub-committee of the Ministry of Reconstruction, which contemplates supplying the kingdom with power from 16 central stations, saving coal to the value of $135,000,000 per annum.

For Consideration of a General Staff

1. If munitions and manufactures consist in the main of metals, if in the latter half of 1917 the production of iron, copper, lead and zinc diminished (as the statistics showed), if the production of coal increased, and if the American railways carried more freight than ever before, why was there a railway congestion and why should there now be fear of a coal shortage?

2. Our Allies have been asking us for barges and tug boats. Washington has said we could not supply them. James J. Storrow, New England Fuel Administrator, addressed to Dr. Garfield a letter under date of Feb. 21, in which he said: "There have been numerous excellent small yards on the coast not fitted to build ships for Government, but which since war began could have constructed many tugs for War Department and had them all completed by this time. Barges for naval use can be built in 60 or 80 days. There are plenty of places where they can be built. It seems to us here particularly unfortunate that the War Department has taken one of our best ocean-going tugs, when there has been plenty of time and plenty of facilities since war began for Government to build the barges and tugs it needs."

Mr. Storrow estimates that the withdrawal of this one tug deprives New England of 200,000 tons of coal supply. Yet we are contemplating depriving ourselves of millions of tons of imported ores and other supplies for lack of shipping, when the furnishing of some tugs and barges to Great Britain and France would have released shipping. There was then no general staff to which this representation could be made.

3. How much might the demand on shipping be reduced by furnishing France with mining machinery to increase the output of her coal mines?

4. In view of the alarm respecting sulphuric supply, why is it not planned to operate every blende-roasting plant and blast-furnace byproduct plant to the limit of capacity and boost the gas with Louisiana brimstone?

5. Why are not steps being taken for recovery of toluol from all possible sources?

Chronology of Mining, February, 1918

Feb. 2—First potash land permit issued under the new law by the Secretary of the Interior, covering 2560 acres of alkaline marsh land in Inyo County, Calif.

Feb. 5—The transport "Tuscania," carrying United States troops under British convoy, was torpedoed off the Irish coast; of the 2401 persons on board, over 100 are dead. One battalion each of Michigan and Wisconsin Engineers, as well as 750 men of the First Forestry Engineers, were on the ship.

Feb. 8—The du Pont Nitrate Co., operating in Chile, told the Delaware section of the American Chemical Society, at its meeting in Wilmington, that not only had the du Pont company succeeded in producing potash in paying commercial quantities from the Chilean nitrates, but had revealed its process to the representatives of companies from the Allied and neutral countries operating plants in nitrate fields.

Feb. 14—Accident causing four deaths occurred just below the 1100-ft. level of the Williams shaft of the Iron Cap Copper Co., at Miami, Ariz.

Feb. 16—The entire foreign commerce of the United States, including all exports and imports without exception, was made subject to control by license by President Wilson.

Feb. 18—Opening day of the 116th meeting of the American Institute of Mining Engineers in New York.

Feb. 19—Decision rendered by the U. S. Circuit Court of Appeals in San Francisco upholding on every point the previous decision rendered by Judge G. M. Bourquin of the U. S. court for the district of Montana, in the case of Clark-Montana Realty and the Elm Orlu mining companies against the Butte & Superior Mining Co., thereby setting a new precedent affecting title to quartz mining claim locations.

Feb. 23—Eleven men trapped in a mine cave near Crystal Falls, Mich. Three were rescued.

Feb. 25—First session of the five representatives each of capital and labor appointed at the request of the Government to outline a basis of relations for the period of the war.

Personals

Have you contributed to the Association for the 27th Engineers?

C. S. McKenzie has joined the 27th Engineers.

A. G. Marsh has left McGill, Nev., and is now in Company C, 18th Railway Engineers, A. E. F.

E. Gybbon Spilsbury left New York on Feb. 24 for Cuba, and expects to be absent about six weeks.

C. F. Kelley, vice president of the Anaconda Copper Mining Co., recently arrived in Butte, Mont., from New York.

George E. Farish left New York on Mar 6 for San Francisco, from which city he will sail for Salvador on Mar. 16.

J. A. Thomas, recently with the Cherokee Copper Co., Michigan, and **Chester A. Gibbs,** of the engineering staff of the North Lake and associated mines, have joined the staff of the Hollinger Consolidated Gold Mines, Ltd., at Porcupine, Ontario.

H. R. Putnam, formerly an engineer in the employ of the United States Smelting, Refining and Mining Exploration Co., has been appointed a captain in the Engineer Reserve Corps and assigned to duty at the General Engineer Depot at Washington.

Guy C. Riddell, recently returned from Port Pirie, Australia, has been appointed metallurgical adviser to the U. S. Tariff Commission in Washington. The commission, of which Dr. F. W. Taussig is chairman, is engaged in preparation for the commercial era after the war.

Milo S. Ketchum, dean of the College of Engineering of the University of Colorado, was selected to direct the immediate construction of one of the two U. S. Government smokeless-powder plants, under the general supervision of D. C. Jackling. **H. A. Fitch,** of Kansas City, will have charge of the construction of the other plant.

Robert H. McMaster, assistant general manager of the Steel Co. of Canada, will soon leave for Washington to act on the new Canadian War Mission, headed by Lloyd Harris, of Brantford, Ont. Mr. McMaster's work on the commission will be principally in connection with the iron and steel industry, in which capacity he will be the Dominion's buying agent.

Henry Morgenthau, former U. S. Ambassador to Turkey, now a director of the American Metal Co., Ltd., recently visited the company's holdings near Baxter, Kan. In the party with him were **B. Hochschild,** president of the company; **C. M. Loeb, Dr. Otto Sussman,** and **R. B. Heberlein.** They were shown over the district by W. H. Eardley, of Joplin, district manager.

Obituary

Donald D. McBean, a civil engineer of much experience in tunnel construction, died in New York on Feb. 27, aged 76 years.

Dr. Arthur H. Elliott, an expert on gases, died at Peekskill, N. Y., on Feb. 28. He was born in London, England, and was graduated from the School of Mines. He later studied at Columbia University, being graduated in sciences in 1881. He had been emeritus professor of chemistry and physics, N. Y. College of Pharmacy, and engineering chemist to the Consolidated Gas Co., New York. He was the author of "Qualitative Chemical Analysis."

Societies

Michigan College of Mines—Minnesota graduates held their eleventh annual banquet at Virginia, Minn., on Feb. 22. The effect of the war was shown in that only 15 were present as compared with the 50 who attended last year.

Engineers' Society of Western Pennsylvania—The structural section bi-monthly meeting was held in the Union Arcade Bldg., Pittsburgh, Penn., on Mar. 5. The paper of the evening was "Simplification of Riveted-Joint Design" by H. A. S. Howarth, of Pittsburgh.

Mining and Metallurgical Society of America will give a dinner on Mar. 21 at 7 p.m., at the Columbia University Club, 4 West 43rd St., New York. Upon this occasion a gold medal will be presented by the society to Pope Yeatman for distinguished service in the administration of mines.

New York Electrical Society held its 11th war meeting on Feb. 27, at the United Engineering Societies Bldg., New York. A paper pointing out that ships were a vital necessity, written by Major Frederick Palmer, of General Pershing's staff, was read by T. C. Martin. Other speakers were Capt. Alexander Macomber and Major A. B. Kratz.

American Institute of Consulting Engineers, Inc., elected the following officers for the year 1918, at its council meeting on Feb. 19: Lewis B. Stillwell, president; Alexander C. Humphreys, vice president; F. A. Molitor, secretary and treasurer. At the annual meeting the following members were elected to take the place of the expiring class in the council: J. Vipond Davies, P. W. Henry and C. M. Ingersoll.

American Society of Civil Engineers held a meeting on Mar. 6 in the Engineering Societies Bldg., New York. Ballots on the proposed revision of the constitution were canvassed. Floyd A. Nagler presented a paper entitled "Verification of the Bazin Weir Formula by Hydro-Chemical Gagings," illustrated with lantern slides. C. F. Brown, of Salt Lake City, recounted his experience in handling unusual drainage problems.

New York Business Publishers' Association discussed the coming drive for the Third Liberty Loan at its regular monthly meeting on Mar. 4. Charles A. Hirschberg, advertising manager of Ingersoll Rand Co., pointed out how advertisers in business papers can and will help "to put over" the Third Liberty Loan. Arthur J. Baldwin, president of Associated Business Papers, Inc., told how business publishers can join forces with the Liberty Loan Committee. Roy Soule, editor of "Hardware Age," and Will I. Irwin dealt with other phases of the subject.

Johns Hopkins University announces that the remaining lectures of the J. E. Aldred series on engineering practice will be given at Baltimore as follows: Mar. 13, "The Operation of a Manufacturing Plant," by Ralph E. Thompson, superintendent, Gillette Safety Razor Co., Boston, Mass.; Mar. 20, "The Control of Stream Pollution," by Earle B. Phelps, Hygienic Laboratory, American Public Health Service, Washington, D. C.; Mar. 27, "The Manufacture of Structural Steel," by Bradley Stoughton, secretary, American Institute of Mining Engineers. The lecture on "The Coal Problem," on Feb. 27 was given by E. G. Bailey, president of the Bailey Meter Co., Boston, Mass., instead of by Ralph E. Thompson, as scheduled. On Mar. 6 Julian C. Smith, vice president, Shawinigan Water and Power Co., Montreal, Can., lectured on "The Growth of Electric Systems."

Industrial News

Fawcus Machine Co., Pittsburgh, Penn., announces the death of its president, Thomas Fawcus, on Jan. 22.

Consolidated Arizona Smelting Co. has ordered two 8-ft. Hardinge ball mills in addition to the Hardinge mill it installed about a year ago.

Bluestone Mining and Smelting Co., of Mason, Nev., has purchased from the Hardinge Conical Mill Co. the two 8-ft. x 36-in. cylindrical Hardinge ball mills which were previously installed at the Inspiration plant.

A. P. Watt, who has opened consulting offices at 52 Vanderbilt Ave., New York, and is making a specialty of ore concentration, desires to receive catalogs from manufacturers of ore-concentrating devices and general mill equipment.

National Safety Council will send to its 3470 industrial, railroad and other members copies of its original publications entitled "Shafting, Couplings, Pulleys, Gearing"; "Engine Guarding and Engine Stops"; and "Oilers and Oiling Devices."

Westinghouse Electric and Manufacturing Co. has moved its office at Phoenix, Ariz., to Tucson, Ariz. Its representatives, J. H. Knost and W. G. Willson, will have their headquarters in the Immigration Bldg., Tucson. W. H. Thompson, who has been engaged in the heavy electric traction work of the company, has resigned to become works manager of the Fairmont Mining Machinery Co., of Fairmont, W. Va., makers of coal-mining equipment.

Worthington Pump and Machinery Corporation—The following appointments have been made, effective as of Mar. 1: James E. Sague, vice president, in charge of engineering and manufacturing; Leon P. Feustman, vice president, in charge of general commercial affairs, including contracts, prices, purchases, traffic, etc.; Frank H. Jones, vice president, in charge of sales; Edward T. Fishwick, general sales manager; Charles E. Wilson, assistant general sales manager; William Goodman, assistant to vice president; William Schwanhausser, chief engineer. The offices of the above will be at 115 Broadway, New York. Neil C. Lamont is appointed works manager, Laidlaw Works, with office at the works, Elmwood Place, Cincinnati, Ohio.

Hardinge Conical Mill Co. has received the following data representing an average run of the new 8 ft. x 30-in. Hardinge ball mill recently installed at the plant of the Miami Copper Co.: Capacity, 45 tons per hour with very hard ore; 50 tons per hour (1200 tons per day) with ordinary ore; primary mill discharge (1200 tons per 24 hours), on 10 mesh, 6.4%; on 14, 7.3%; on 20, 9.9%; on 28, 15.8%; on 35, 8%; on 48, 9.1%; on 65, 5.9%; on 100, 6.7%; on 150, 5.1%; on 200, 2.7%; through 200, 23.1%. Product of secondary mills: on 28, 1%; on 35, 1.7%; on 48, 4%; on 65, 10%; on 100, 15.6% on 150, 13.9%; on 200, 6.5%; through 200, 47.3%. Cast iron balls used: 600 lb. 4½-in. balls added to primary mill per 24 hours; 750 lb. 2-in. balls added to each secondary mill per 24 hours. A fraction of 1 lb. cast iron balls is consumed per ton of ore ground. The 1200 tons per day crushed by the one primary ball mill is recrushed for flotation extraction in two 8 ft. x 30-in. ball-pebble mills. The three mills take a total of 360 hp., making approximately 3⅓ tons per hp. from mill bin to 48 mesh.

Trade Catalogs

Fenestra Straight Line Operator for opening steel sashes. Detroit Steel Products Co., 2250 East Grand Blvd., Detroit, Mich. Folder, 5¾ x 11¾ in. Description of a device that will open a Monitor sash 60° or the full 90°, if desired.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Aluminum—Solder for, composed of zinc and tin, in the proportion of two to one, and a relatively small proportion of sal-ammoniac. John J. Aubertin, Jr., St. Louis, Mo. (U. S. No. 1,256,285; Feb. 12, 1918.)

Mine-Car Running-Gear—John Lee McDowell, Berwick, Penn., assignor to American Car and Foundry Co., New York, N. Y. (U. S. No. 1,256,148; Feb. 12, 1918.)

Mine-Car Wheel. Lubricated. John Lee McDowell, Berwick, Penn., assignor to American Car and Foundry Co., New York, N. Y. (U. S. No. 1,256,151; Feb. 12, 1918.)

Mine-Car Wheel and Axle. Frederick H. Gibbs, Brooklyn, N. Y., assignor to American Car and Foundry Co., New York, N. Y. (U. S. No. 1,256,484; Feb. 12, 1918.)

Mine-Car Wheel with Hub-Cap. Warren V. Johnson, Bloomsburg, Penn., assignor to American Car and Foundry Co., St. Louis, Mo. (U. S. No. 1,256,137; Feb. 12, 1918.)

Mine-Car Wheel and Means for Attaching Same. Warren V. Johnson, Bloomsburg, Penn., assignor to American Car and Foundry Co., St. Louis, Mo. (U. S. No. 1,256,136; Feb. 12, 1918.)

Ore-Separating Apparatus. Ray P. Saffold, Douglas, Ariz. (U. S. No. 1,256,263; Feb. 12, 1918.)

Rock Crusher—Featuring the combination with the pitman of a spring counterbalancing means located below to support the pitman and take its weight from its bearing. Richard Bernhard, Milwaukee, Wis., assignor, by mesne assignments, to Worthington Pump and Machinery Corp. (U S. No. 1,256,289; Feb. 12, 1918.)

Titanium Ores—Concentration of. Maurice Roger Raffin, Dunkirk, France, assignor to Société P. Raffin and Fils, Dunkirk, France. (U. S. No. 1,256,368; Feb. 12, 1918.)

Tunnel Construction—A lining of concrete block sections. Cornelius G. Hastings, West Hoboken, N. J. (U. S. No. 1,256,312; Feb. 12, 1918.)

Tunneling-Shield. Cornelius G. Hastings, West Hoboken, N. J. (U. S. No. 1,256,313; Feb. 12, 1918.)

Editorial Correspondence

SAN FRANCISCO—Feb. 28

Union Consolidated, Comstock's Chief producer on the north end, has declared a second dividend of 5c. a share, payable Mar. 1. The 2400 level continues to yield high-grade ore, and the raise from the 2500 level, north drift, is also continuing the production of high-grade. The high-grade ore averages about $60 per ton. On the 2100 level of the Ophir the ore averages $18 a ton, and exploration of wide areas in promising ground is in progress. Sierra Nevada is still driving north in a new ore-shoot recently disclosed and assaying $30 per ton. The Mexican mill is kept supplied with large tonnage of good grade of ore, and all of the companies, both in the North End, and the Gold Hill districts, are advancing development work. The North Middle mines are still in operation, awaiting the installation of larger pumps. It is believed that pumps will be obtained and the unwatering of these properties be in progress toward the end of the firs half of the present year.

California Oil Producers are advised by Mark L. Requa, director of the oil division of the Fuel Administration, that the Lever bill contains no provision for fixing prices. Mr. Requa states in his letter that, even if there were such powers in the bill, there are other more important problems to be solved at this time. Mr. Requa states that the wildcatter should be encouraged to continue activity in the knowledge that his reward will not be circumscribed, and that the producer should be encouraged and urged to continue production and at a price which will return a fair profit on his investment, keeping in mind the hazards of the industry. The Lever bill does permit fixing profits, and its provisions contemplate prevention of waste, licensing under specific rules, seizure for hoarding, punishment for conspiracy and the right to commandeer and to seize products as well as plants and factories. Mr. Requa is so well known for his expert knowledge and professional ability that his appointment to a position in the Fuel Administration has given general satisfaction in California and has been a source of great encouragement to oil producers in all the fields in the state.

Precipitation of Snow and Rain has been insufficient during the season to provide water for hydraulic mines, and many other mines have been close to a shortage until the middle of February. The storms which began Feb. 16 give promise of fair amount of snow and rain to enable the miner to proceed on the basis of a fairly good season. The snow at Truckee, which was the first of importance for the winter, measured 18 in., and the rate of precipitation indicated on Feb. 17 that a depth of 4 ft. would be reached within 24 hours. Reports indicate that there is fair amount of snow on the western slope of the Sierra, also in the foot-hill counties, in the Siskiyou Mountains and the northern end of the Coast Range. The rain was general from north to south throughout the valley regions. Up to Feb. 15 there was much fear of a shortage of snow, and the lack of rain in the valley was shortening the feed for the stock, resulting in the death of large numbers of cattle and sheep. Unless there should follow an exceedingly hot spell the amount of snow will probably be sufficient to carry the mines along until late in the season, and the rain will have supplied the power and irrigation reservoirs to an extent that will obviate the necessity of drawing on the snow reserves at an early period.

Conference of Oil Men representing 60% of production was recently held at the office of Fletcher Hamilton, state mineralologist. The participants in the conference represented the Associated, Amalgamated, General Petroleum, Shell, Standard and Union, also the Southern Pacific and Santa Fé and several Doheny companies. The purpose was the discussion of the war-time necessity for the most thorough and systematic methods of development and production in California oil fields. Recently R. P. McLoughlin, state oil and gas supervisor, called the attention of various large producers to the superior methods already in use by certain operators, and as a result all but one of the companies having an annual production in excess of 1,000,000 bbl. have signified their intention of adopting plans which make use of the most recent advancement in oil engineering and development of field practice. The officials in this conference recognized that a general adoption of the best methods by all large concerns will lead to the quickest results and also to the adoption of similar methods by such small operators as have not already taken such a course. There are 10 or more of these small companies which have for some time been following systematic methods. The discussion brought out many facts not generally recognized because all engineering work involves the consideration of many small details. Oil-field development work is divided into two classes, technical and mechanical. It was pointed out that the commonly used terms "practical" and "theoretical" cannot be defined and therefore have no place in these discussions. Details of field practice which gave promise of reduced costs were considered. Plans will be made for further meetings for discussion of individual problems.

SALT LAKE CITY—Feb. 27

Extensive Coal Deposits in Iron County, in the southern part of the state, 32 miles east of Lund, on the Salt Lake route—known as the Colorado Plateau coal fields—are in prospect of being opened. A beginning has been made in the formation of the Iron County Coal Co., which will begin development, in a conservative way, mining only such material as can be readily marketed. Adequate transportation must be provided before operation on a large scale will be possible, but the company is building a two-mile tram, the completion of which is expected in ninety days. An especial point of interest in regard to the coal deposits is their proximity to the well-known iron deposits, which gave the county its name. There is little doubt as to the value and extent of the iron ore deposits. Successful experiments have been made as to the best method of treatment and it is only a question of time when they will be mined.

WALLACE, IDAHO—Feb. 28

Selective Flotation Has Been Established as a milling possibility in this district applied to the recovery both of lead and zinc as separate concentrates. The solution of this problem is also receiving much attention in the experiment station maintained by the bureau of mines in connection with the state university at Moscow, where definite progress has been made. Among the metallurgists connected with the mines of the Coeur d'Alene district, it is probable that W. L. Zeigler, metallurgist and mill superintendent of the Success Mining Co., Ltd., has made the greatest advance toward a practical solution. This week Mr. Zeigler exhibited samples of lead and zinc recovered in his laboratory experiments by differential flotation from Success slime. The lead concentrate is nearly free from zinc, being 79% pure. The zinc concentrate assays 43% zinc and contains a little lead. The tailings showed but a trace of lead or zinc. So satisfactory have been the results of these experiments that Mr. Zeigler expresses confidence that he will soon be able to apply the process on a commercial basis. The importance of these experiments is indicated by the statement of the Success management that the successful application of differential flotation will add 50% and probably more to the profits derived by the company from flotation product.

During the Previous Session of Congress a bill was introduced declaring a moratorium applicable to notes, contracts, mortgages and other forms of civil contracts involving men serving in the Army and Navy and to extend until the close of the war. This bill failed to pass, and nothing has been heard of it during the present session. To the average citizen this proposed law is so manifestly fair and just that it is impossible to understand why Congress has delayed its passage. From Camp Lewis comes the information that many soldiers who were paying for their homes or land under the installment plan are confronted with the possibility of losing their property and the payments already made, which is naturally causing them great anxiety. Certainly a soldier who is serving his country and actually offering his life, with compensation at the rate of $30 per month, should be protected by his Government and be freed from worry regarding such obligations. In this connection there is a matter that is giving soldiers from the mining states much concern and in which they feel that they are entitled to Government relief. Take the Coeur d'Alene district as an example. This county, Shoshone, has already sent nearly a thousand men to the war, without counting those who will respond to the next draft. By a conservative estimate, 75% of these men have shares in mining stock companies. The operations of these companies are financed by assessing the stock, and shares upon which the assessments are not paid are sold at public auction on a designated date. Now, two things are perfectly obvious. As a practical proposition it is impossible for soldiers serving "somewhere in France" to receive notices of assessment within the legal time, and if they could receive the notices it would be impossible for them to pay the assessments out of their meager stipend. These men feel that a great wrong will be perpetrated by the Government if their holdings are not protected through the enactment of a moratory law which would exempt their shares from assessment, or at least would prohibit their sale and permit them to reclaim the stock when they return to civil life by the payment of the accumulated assessments. Certainly the sacrifice these men are making is enough without adding to it the loss of their property. Some mining companies are recognizing the justice of this claim and are carrying the shares of men who are serving in the Army and Navy.

BUTTE, MONT.—Feb. 28

The First Company of Home Guards was formed at Great Falls on Feb. 17 by members of the Metal Trades Council of Great Falls, Mont., who organized what they claim will be the first company of home guards formed under the law governing the subject now before the special session of the Legislature of Montana. The formation of such organizations to supplement or replace the regular soldiers in industrial centers of Montana and punishment for persons instrumental in starting labor troubles were the topics under discussion at a meeting held at Butte on Feb. 16 by the American Alliance for Labor and Democracy.

Operations in Neihart, Cascade County, have started where silver mines have been taken under control by Boston interests through the efforts of George H. Brabrook, of Boston. In a short time the concentrator on the property will be operating. The property consists of the Moulton mine, with four patented claims; the Broadwater mine, with four patented claims and one unpatented claim, a well-equipped concentrator, water rights and several house lots. The property has direct railroad connection, with plenty of cheap coal, and water and timber are available. The Moulton is down to a depth of 500 ft., and approximately $900,000 worth of silver ore has been shipped to the smeltery, averaging from 50 to 75 oz. per ton, with 3 to 10% lead and $2 to $4 in gold per ton.

Creating Dissension Among Various Unions, that would ultimately result in a strike and cessation of mining operations in Butte, seems to be the object of certain labor elements which recently made an attempt to revive a grievance against union members, on account of their attitude during the troubles of last summer. It appears that at that time these men continued at work for the Anaconda in capacities where their services meant keeping the properties in condition to resume operations at full capacity as soon as the differences were settled. At recent meetings of the trade unions affected it was decided to insist that the Anaconda company either discharge these men or pay a fine of $500 for each one in order to put him in good standing with his union. Failing a compliance with this demand on the part of the Anaconda company, it was suggested that a general strike be called pending an adjustment of the demand. The company announced that it would await whatever action the men might take before deciding on any course. Since then the individual unions held more

meetings, at which the matter of strike was discussed at length without reaching a definite conclusion. Thus the matter stood until last night, when a meeting was called of the Metal Trades Council to decide once for all whether there should be a strike or not. While the meeting was of a more or less secret nature, it was announced this morning that the differences were settled and the threatened strike was averted. It is reported that the fines were paid, a rumor that has not as yet been verified. The news came as a great relief to the whole community, which is loath to see the distressing conditions of last summer repeated.

HOUGHTON, MICH.—Feb. 27

Greater Utilization of the Red Jacket Shaft and the Tamarack No. 5 shaft is under consideration by the Calumet and Hecla. The Red Jacket shaft has a capacity of 3000 tons daily. There are six compartments, two for ore, one for bailing, one for supplies and one for men. The shaft goes vertically to the 81st level. It is nearly a mile from collar to sump, the levels being measured on the dip of the conglomerate. All of the Hecla and South Hecla shafts on the conglomerate lode of the Calumet and Hecla mine are deep. Measured on the incline, according to the last annual report, No. 6 shaft was 7874 ft., 133 ft. under the 79th level, and No. 7 was 7977 ft. or 140 ft. under the 80th level. Both are deeper at this time. At the South Hecla No. 8, sinking was discontinued at 6120 ft. At the South Hecla No. 9 and 10, the depth attained is 8132 ft., 142 feet under the 82nd level.

JOPLIN, MO.—Feb. 26

The Preparation of Ores for High Grade Spelter in this district is being contemplated by producers. They have been assured by a local chemist that a considerable proportion of the production here is sufficiently lead-iron- and cadmium-free to permit of its use for making high-grade spelter. It has been proposed that particular selection of ores be made, and that smelters be asked to establish a new basis for purchasing other than that of the time-honored 60% metallic basis. It is declared that with a cadmium- and lead-free basis, producers of these ores might expect to get $10 per ton over present prices.

Deeper Mining in the Galena Camp seems assured as a result of recent development operations by the Wayland Mining Co. This company's mine is located about a mile and a half southwest of Galena, where most of the production comes from above 200 ft. The mine, in fact, still is a good producer from the 90 ft. level. Last summer, however, after several drill holes had shown a deeper "run," the company started sinking its shaft. It has now reached 285 ft., and for 50 ft. has been passing through excellent ore. Drifting has been started, and for 30 ft. from the shaft ore has been proved that will yield a mill recovery of 15 to 20% zinc concentrates, lead free and averaging in grade from 62 to 63% metallic zinc. At a distance of 900 ft. south from this shaft, drill holes have shown a similar occurrence of ore at the deeper level, and 1500 ft. southwest other holes also have demonstrated a similar occurrence. Unquestionably there will be considerable activity in this camp, and probably a new period of development. The St. Clair Oil Co., a strong Kansas organization, has leased several hundred acres of land south of the Wayland and will start drilling immediately, and other drilling for the deep ore level is being planned. A mile north at the Empire mine a shaft was started for the deep level several months ago, but numerous delays have prevented its completion. Work in this shaft, however, is now being pushed. One important feature of the lower level "run" is its quality. Virtually all of the upper run ore in the Galena camp has been second grade.

TORONTO—Feb. 28

Improvement in Labor Conditions in most of the Northern Ontario mining camps is reported. The Cobalt mines have all the men they require, and similar conditions prevail in the Kirkland Lake field, where many men are applying for work. Other new camps are also stated to be well supplied with labor. At Porcupine the high wages paid by the Hollinger and the McIntyre, in the case of the former ranging from $4 to $8 per day, have been an unsettling influence, as many men are unwilling to work for the companies paying less wages, preferring to leave the camp and look for jobs elsewhere.

MELBOURNE, AUSTRALIA—Jan. 28

The Mount Morgan Company at Queensland during the half year ended Nov. 25, 1917, treated 150,174 tons, yielding 4014 tons of copper and 48,081 oz. gold. The mill treated 91,135 tons of ore, producing 31,693 tons of concentrates, assaying 5.61% copper and 0.577 oz. gold.

The Output From Broken Hill Mines in 1917 included 213,618 tons of silver-lead concentrates, 278,544 tons of zinc concentrates, and 28,890 tons of carbonate ores; a total of 520,952 tons, valued approximately at $19,400,000. The strike in August and September affected the production of the last two quarters. Results of work on the outside mines are not included in the figures mentioned. The output for 1916 was valued at $18,750,000, and for 1915, $16,150,000.

New Zealand Production in 1917 showed that the Waihi Gold Mining Co. treated 191,742 tons that yielded bullion valued at $1,600,000. The total value of bullion won from this mine to date is $57,400,000 and the dividends paid amount to $24,000,000. The Waihi Grand Junction Co. treated 116,130 tons that yielded bullion valued at $1,000,000. The total amount of bullion obtained from this mine to date is $7,950,000, and dividends paid, $1,160,000. The Talisman Consolidated Gold Mining Co. at Karangahake yielded bullion valued at $675,000. The total bullion output to date from this mine is $13,450,000 and the dividends paid since the reconstruction of the company amount to $5,320,000.

The Mining News

ALASKA

SHIPMENTS TO UNITED STATES of domestic copper ore, matte, etc., from Alaska in January were 13,400 gross tons, containing 6,131,821 lb. copper, evaluated at $1,440,996.

ALABAMA

Coosa County

DURO-FLAKE GRAPHITE CO. (Montgomery)—Owns and is developing 252 acres of graphite land on Flaketon Ridge. First unit of mill, with capacity of 40 tons per hour, being erected and expect completion Mar. 15. Machinery ordered and ground broken for second unit. L. C. Davis is president.

ARIZONA

Pima County

WAKEFIELD-BELBER (San Xavier)—Silver-zinc ore struck at a depth of 105 ft. in shaft in altered limestone containing stringers of quartz. Copper ore occurs both in the stringers and disseminated in the limestone. Shaft to be continued 100 ft. deeper in expectancy of cutting other veins. Operations conducted by Reiniger & Freeman.

Pinal County

McCALLUM (Ray)—Property adjoining the Ray Lead Development is to be opened up by Jim Pollard.

TROY ARIZONA (Kelvin)—Crosscutting on the 500 level has cut the same hard limestone found in shaft. Crosscut advanced 200 ft.

BRANCH GROUP (Kelvin)—Recent development northeast of Kelvin has opened up a considerable quantity of silver-lead ore. On one claim a find of asbestos was made.

U. S. VANADIUM (Kelvin)—New 50-ton plant, having the Bryan dry concentrator and mechanical dry sizer, is completed and being tried out. Will go into regular service in March.

BROKEN HILLS (Ray)—Sinking in main shaft has attained depth of 265 ft. At the 100 level, 165 ft. below the tunnel level, a station was cut. On the 200 level some copper ore opened up. W. F. Gordon in charge.

Yuma County

BLACK REEF C. CO. (Salome) — At property north of Wenden, in the Harqua Hala district, a shoot of ore carrying 2 oz. gold and considerable copper has been opened on the 300 level. Operations are in charge of H. E. Willham.

CALIFORNIA

Amador County

FREMONT (Drytown) — Shaft reached 2950 ft. point and station now being cut for the 2900 level. The holdings include four claims, extending 4200 ft. along the Mother Lode.

Humboldt County

MANGANESE DEPOSIT near Fort Baker, known as the Red Knoll, optioned by W. E. Olmstead, William T. Dawkins, and Joseph and J. M. Knight. Reported assays 51.8% and large amount available. Charles Brewer, owner, will receive royalty of $4.50 per ton.

PLUTUS (Eureka) — Property recently acquired by Chief and under development by that company. Body of quartz opened at depth expected to show ore, and being prospected by drifting in two directions as well as by sinking and raising.

Napa County

MANUEL (Calistoga)—Property leased to Gohlin Gold and Silver Mining Co. Old workings to be repaired and 200 ft. of new tunnel to be driven immediately.

Nevada County

OUSTOMAH (Grass Valley)—Mill producing 30 tons of chrome ore daily with 10 stamps dropping. Ore is hauled from Sweet Ranch, at Lime Kiln, with motor trucks. Chrome ore is separated from other minerals. Concentrates are shipped East by mail.

DELHI (Columbia) — New compressor installed and ready for operation. Shaft extends several hundred feet below lower tunnel level, and pumps will be started immediately to unwater drifts and stopes. New railroad built to connect mine with main Alleghany road. A. A. Codd is manager.

Shasta County

MAMMOTH (Kennett)—Reported that large tonnage of ore being shipped to the smeltery from Mayflower mine at Pioneer, Nev. The ore is high-grade quartz that cannot be treated at profit in stamp mill operated at mine.

MOUNTAIN COPPER CO. (Keswick)—Progress being made toward completion of 500-ton addition to concentrating plant situated at Minnesota Station. New territory recently explored in the mine promises large increase of available ore.

Siskiyou County

RANCHERIA (Hornbrook) — New crusher installed and mill started. Flume built to carry water and tailings over the head of Wagner ditch.

KLAMATH RIVER DISTRICT comparatively active. Reynolds Creek mine being operated by drifting. Ed Mann and associate have several men at work. Blue Nose mine ready as soon as water is available.

MARCUSSEN (Orleans Bar)—Owing to lack of snow and rain, this mine and the Salstrom are the only ones worked so far this season. Late snow and rain in the middle of February will probably enable other hydraulic mines to operate at least a part of the season.

Tuolumne County

BIRNEY (Sonora)—Herbert Shaw and Frank Beal, developing lease, disclosed good milling ore and recently shipped high-grade from a 6-ft. vein.

MANGANESE ORE in Moccasin Creek 16 ft. wide and has been traced on the surface for more than a mile. Optioned by John F. Munn.

COLORADO

Gilpin County

ANNEX (Central City)—This Lake Gulch mine, idle for years, to be reopened by Montana men.

Lake County

FAIRVIEW (Leadville) — Deposit of low-grade manganese ore containing considerable iron opened recently. Deposit probably lenticular, 120 ft. thick. Lateral extent not fully determined.

Ouray County

ST. LAWRENCE (Ironton) — Red Mountain mine to be reopened by development at once.

CAMP BIRD (Ouray)—New tunnel advanced 600 ft. in January. Expect completion by May 1. Three new veins cut.

CALLIOPE (Ouray)—Power plant, compressor and air drills installed and development work under way. Driving on 4-ft. vein of silver-lead ore and regular shipments made. Mine in Dexter Creek district.

Park County

LONDON M. & RED. CO. (Alma)—Driving 4000 ft. to open orebody 600 ft. below present workings. About 1000 ft. completed.

San Juan County

ST. PAUL (Silverton)—Worked by lessees. New electric hoist installed. Ore is copper with considerable silver.

San Miguel County

STANDARD CHEM. CO. (Placerville)—Recently installed two 3½ ton auto trucks for hauling carnotite ore to railroad.

PRIMOS CHEM. CO. (Vanadium)—Lack of supplies caused curtailment. Operations to be resumed on full scale in short time.

BELMONT-WAGNER (Telluride)—Construction of mill progressing. Large crew working on development and big tonnage will be ready for mill.

Summit County

MOLLY B (Breckenridge) — Examined for purchase recently. Mine a producer of bismuth ore.

WELLINGTON (Breckenridge)—Sixth level raise cut main oreshoot. Mill operating steadily.

TONOPAH PLACERS CO. (Beckenridge)—No. 2 dredge to be completely overhauled, and new machinery installed.

IRON MASK (Breckenridge) — New shoot of lead carbonate ore opened on lower workings, below iron sulphide ore.

FRENCH GULCH DREDGE (Breckenridge)—Dredging operations closed for winter; repairs being made.

ROYAL TIGER (Breckenridge) — Good-grade lead-zinc gold-silver ore opened in winze from main tunnel level. Grade increasing with depth. Winze 60 ft. deep.

POWDER RIVER DREDGING (Breckenridge)—When transformers installed and electric power line is connected, dredge will be ready to begin operations on B. & L. placer on Blue River below town.

BUNKER HILL (Breckenridge)—All interests of lessees to be taken over by Bulkeley Wells and associates. Electric hoist and compressor to be installed and shaft deepened.

MONTE CRISTO (Breckenridge)—Mill completely overhauled and new machinery installed. Test lots to be milled to determine further alterations. Property in upper Blue River section.

TONOPAH PLACERS (Breckenridge)—No. 1 dredge working in Blue River north of Breckenridge; No. 2 dredge, on Swan River, being overhauled for next campaign; No. 3 dredge, in French Gulch, shut down on account of water shortage. This dredge usually works all winter.

Teller County

MODOCK (Cripple Creek)—Development under way.

UNITED STATES MINES CO. (Cripple Creek)—Production made largely by lessees.

VICTORY GOLD MINING CO. (Cripple Creek)—Shipping from Beacon shaft of Prince Albert group.

GRANITE GOLD MINING CO. (Cripple Creek)—Regular production made from Dillon and other shafts.

ELKTON (Cripple Creek)—Lessees mining good-grade ore on Henley vein between 3rd and 4th levels of Elkton shaft. Lessees in Tornado also producing.

CRESSON (Cripple Creek)—Recent development work on 10th, 11th and 12th levels has opened good-grade ore.

TRAIL (Cripple Creek)—Lessees making regular production from this United Gold Mines Co.'s mine.

ELKTON (Elkton)—The mine plant has been completely electrified and a new 120-hp. compressor has been installed at the main shaft. The old steam plant has been dismantled and the boilers have been sold and removed.

CRIPPLE CREEK DIVIDENDS paid Jan. 10 were: Cresson Consolidated Gold Mining Co., 10c. per share; total, $122,000; Golden Cycle Mining and Reduction Co., 3c. per share; total, $45,000; Granite Gold Mining Co., 2c. per share; total, $16,500.

VINDICATOR (Cripple Creek)—Production increasing. In milling plant about 600 tons per day treated. Flotation said to be making better extraction. Large tonnage of low-grade ore on dumps may be treated.

FOREST QUEEN (Cripple Creek)—A new oreshoot has been opened recently from the 650-ft. level by the Gaylor Leasing Co. The ore assays from $30 to $40 a ton. Shipments are being made to the Golden Cycle Mining and Reduction Co., at Colorado Springs.

LUCKY CORNER (Anaconda) — This property of the Doctor Jack Pot Mining Co. is being developed under lease by F. L. Wilcox and associates. Considerable ore has been opened, assaying $30 to $40 a ton. Shipments are being made from Anaconda Station to the Golden Cycle Mining and Reduction Co., at Colorado Springs.

IDAHO

Shoshone County

SUCCESS (Wallace)—Lead oreshoot on 1500 level proved by drift for 125 ft. On the 1600 level a little lead has been found which may prove to be the same shoot. Diamond drill on the 1400 level recently passed through small body of zinc. Management reports a substantial profit in January.

BIG CREEK (Wallace)—Following the strike of a few weeks ago, when 12 ft. of high-grade milling lead-silver ore was discovered, drifting was started east. Ten feet was driven, when the lead disappeared and in its place has appeared four feet of gray copper ore. A careful sample taken across the face returned 56.8 oz. of silver per ton and 0.8% copper. A selected sample from a solid streak of ore returned 929.1 oz. silver per ton and 11.1% copper. On the west side of the crosscut the lead-silver ore continues. Shipments will soon begin. Ore to the extent of $100,000 has been shipped from the tunnel 560 ft. above.

MICHIGAN

Copper

ALLOUEZ (Allouez)—Milling 1900 tons of ore daily.

NEW ARCADIAN (Houghton)—In drift 17th level disclosed new amygdaloid lode.

ISLE ROYALE (Houghton) — Milling 3000 tons of ore daily.

HANCOCK (Hancock) — January production 276,000 lb. of copper.

OSCEOLA (Osceola)—Lack of men at North Kearsarge and February output was low.

MOHAWK (Mohawk)—Shaft No. 1 bottomed at 25th level, No. 4 at 24th, No. 5 at 20th and No. 6 at 15th.

FRANKLIN (Demmon)—Daily output over 1100 tons. When 6 drills get to stoping, will hoist 1400 to 1600 tons per day.

AHMEEK (Ahmeek)—Shipping from four shafts. No. 3 and No. 4 not yet fully developed. Not milling Allouez ore now.

INDIANA (Lake Mine)—Encouraging unidentified lode 25 ft. wide passed through in northwest crosscut; will be explored later.

NORTH LAKE (Lake Mine)—Uncorrelated lode 8 ft. wide cut by northwest crosscut, having promising showing; after Butler and Evergreen series are penetrated, new lode will be explored.

BEAR LAKE POOL (Calumet)—Finished 6th diamond drill hole; starting 7th. Exploring virgin territory west of formations formerly thought to be on Freda or Western sandstone.

LAKE (Houghton)—February shipments of ore from the Lake mine likely will be 6500 tons. In January, the tonnage was 6300. This is an increase of 25% over the output of a year ago. Increases are likely to continue.

MAYFLOWER-OLD COLONY (Houghton)—Shaft to explore the lode found by drilling both properties down 200 ft.; several hundred more to go. Will proceed faster than heretofore, as regular hoist is now ready.

MICHIGAN (Rockland)—Resumed shipping to Winona mill; lack of cars; motor truck equipped so that it conveys ore on 1200-ft. spur to main line of M. & St. P. R.R. Good oreshoot on 6th and 5th levels. Butler lode found on 4th.

CALUMET AND HECLA (Calumet)—January copper production was: Ahmeek, 2,095,488 lb.; Allouez, 737,779; C. & H., 6,111,104; Centennial, 263,433; Isle Royale, 1,038,562; La Salle, 150,963; Osceola, 1,309,533; Superior, 179,837; White Pine, 253,498 lb., yielding a total of 12,140,197 pounds.

SENECA (Calumet)—Started vertical shaft Jan. 14. New company formed about nine months ago by Adolph Lewisohn and associates, when option from Calumet & Hecla was exercised. Entirely new mining plant, shaft house, engine house, with hoist and compressor shops, office, warehouse, boarding and officers' houses just completed.

LAKE MILLING, SMELTING AND REFINING CO. (Point Mills)—Stopped work in Centennial-Allouez mill at Point Mills on two new stamps for some time, as not needed with present production; has now six stamps working at this mill, and three stamps with another in construction at No. 2 at Hubbell, the former on rock from Allouez (in part), Hancock, Superior, La Salle, Isle Royale (in part) and latter on Centennial and Allouez (in part).

MISSOURI

Joplin District

RED WASP (Aurora) — Starting up again after several months' shut-down.

MIAMI-ADA (Quapaw, Okla.) — Plans building mill on lease near Quapaw where successful drilling campaign was recently completed.

FREEHOLD OIL & GAS (Joplin)—Completed shaft sinking at Liberal mine, Waco; also completed new mill and production started. W. S. Marquis, Webb City, manager.

DOUBLE LEW (Galena)—Draining operations started in shaft preparatory to sinking to 300 ft. Shaft now at 116 ft. J. McKanna and associates, of Oklahoma City, owners.

M. K. & T. (Granby)—Started up again after several months' shut-down. New officers elected. S. J. Williams, Smithfield, Mo., president; C. A. Davis, Neosho, general manager.

MONT B (Webb City) — Receivers for this property will sell mill and entire property, ore stocks excepted, at public auction to be held at mine on Mar. 21. Big sheet-ground mill. W. H. Warren, Joplin, and C. A. Blair, Carthage, receivers.

WACO MINING CO. (Joplin)—Drilling big hole at No. 1 plant and will install 12-in. Pomona pump at once to drain ground to 200 and later 300 level. Mine has been good producer at 140 ft. and drill cuttings showed best ore at lower levels.

COAHUILA (Webb City)—Has sold No. 1 mill, which has been in operation north of Duenweg, to Landreth Machinery Co. Is a 350 ton per shift mill and property has been big producer of sheet-ground section. Company to continue operation of No. 3 mill.

MONTANA

Lewis and Clark County

HELENA MINE (Helena) — Orebody holding firm above 300 level.

CRUSE CON. (Helena) — Galena ore struck in crosscut on 150 level from Looby shaft.

SILVER LEAD (Little Creek)—Eighteen inches of $700 silver ore at a depth of 250 feet.

COFFEY-BYRNES L. CO. (Helena) — Hauling high-grade silver ore to Rheem Spur for shipment to smeltery.

CRUSE DEVELOPING CO. (Helena)—Permanent oreshoot uncovered at 640 level east of shaft. Ore above and below drift.

SCRATCH GRAVEL CO. (Helena)—Mine worked out to side line of placer location on 500-ft. incline. Pumps pulled and work stopped. Management hunting other claims with view of continuing operations.

Mineral County

TARBOX (Saltese) — Plans being prepared for mill of 300 tons to be built this summer. Recent development on 800 level shows body of milling zinc-lead ore.

INTERMOUNTAIN (Iron Mountain)—Shipping two carloads of crude ore and concentrates per week. Shaft down 700

ft., but present work is on 400 level and above. Mill has 100 tons capacity, which is to be increased.

Silver Bow County

ELM ORLU (Butte)—Won suit against Butte and Superior.

NORTH BUTTE (Butte)—Hoisting 1200 tons per day from Granite Mountain and Speculator shafts.

TUOLUMNE COPPER M. CO. (Butte)—Sinking Sinbad shaft from 700 to 825 ft. level to cut Spread Delight fissure mouth of the shaft by a 700 ft. crosscut.

ANACONDA (Butte)—Daily production now between 18,000 and 19,000 tons of ore. Zinc plant at Great Falls producing electrolytic zinc at about 100 tons per day.

DAVIS-DALY (Butte) — Production in January was 1,000,000 lb. copper and 75,000 oz. silver. 500 men employed at the Colorado and Hibernia mines. May exercise option in Mount Moriah mine. Ship copper ores to East-Butte Pittsmont smeltery. Silver-zinc ores shipped to Anaconda.

BUTTE AND SUPERIOR (Butte)—About 47,000 tons of ore mined from the Black Rock in January. Mill heads average 17% Zn, grade of concentrates, 50% Zn, and a mill extraction of 94%. Zinc produced was 14,600,000 lb. and silver 15,000 oz. No. 3 shaft was completed to the 2100 level and stations being cut on the 1900 and 2000 levels.

EAST BUTTE (Butte)—Principal tonnage from 1000, 1200 and 1500 levels, and 1800 level is yielding considerable ore. Several orebodies being mined. First class ore 7% copper and second class ore 3.3% copper. Flotation plant of 1000 tons daily capacity treats the second-class ore and former tailings. Company's smeltery at Pittsmont steadily increasing output of copper. January production 2,574,140 lb. from East Butte ores and Davis-Daly custom ores.

NEVADA

Esmeralda County

RED HILL FLORENCE (Goldfield) — Ore struck on 450 level in 18-in. vein reported to assay exceedingly high in gold.

Lyon County

MASON VALLEY MINES CO. (Thompson)—The second furnace has been blown in and is treating 650 to 800 tons of copper ore a day.

Nye County

TONOPAH ORE PRODUCTION for week ended Feb. 9 amounted to 10,760 tons, valued at $182,920, compared to week ending Feb. 2, 11,038 tons valued at $187,646. Producers were: Tonopah Belmont, 2501 tons; Tonopah Mining, 3500; Tonopah Extension, 2380; Jim Butler, 466; West End, 1114; MacNamara, 578; Montana, 132; Cash Boy, 50; and miscellaneous 39 tons.

LIBERTY MINE (Tonopah) — Twenty miles north of Tonopah. W. H. Aubrey, superintendent, announces discovery of shipping ore at depth of 60 ft.

WHITE CAPS (Manhattan)—West drift on fifth level extended 30 ft., now 320 ft. from shaft. Shale and quartzite continue. Raise 506 discontinued and sill floor east of the raise is now being cut. Raise and sill demonstrate high-grade mill ore. An average of 100 tons per day hoisted during week. Decision in White Caps vs. Morning Glory apex case was in favor of White Caps.

White Pine County

GIROUX CON. MINES CO. (Kimberly)—Experimental 1000-ton mill, which has been down for repairs since Jan. 1, to start up again in March.

TENNESSEE

Knox County

TENNESSEE MANGANESE CO. (Knoxville)—Has raised its capital from $20,000 to $200,000, for purpose of constructing a $100,000 iron furnace either at its Sevierville mines, or at Knoxville. Also planning development of manganese properties at the foot of Big Smoky Mountains.

Polk County

TENNESSEE COPPER AND CHEMICAL CO. (Copperhill)—Has been awarded reparation by the Interstate Commerce Commission on 51 tank carloads of sulphuric acid on which the Louisville & Nashville R.R. Co. collected an excessive rate.

TEXAS

TEXAS COPPER AND REFINING CO. (Denver)—Newly incorporated in Colorado to exploit red-bed copper deposits in north central Texas. Contemplate development and erection of custom smeltery. Walter P. Dietz is president with offices at 527 Cooper Bldg.

UTAH

Beaver County

COPPER MOUNTAIN (Milford)—Old mine 12 miles northeast of Milford being worked and ore opened in several places.

Juab County

TINTIC STANDARD (Eureka)—Two weeks ended Feb. 16, shipped 28 cars of ore.

GODIVA (Eureka)—New ore opened on 750 level. Working from tunnel to 900 level. Also on 1200 level.

EUREKA MINES (Eureka)—Raising from 900 and sinking from 700 levels, apparently on same oreshoot.

GEMINI (Eureka)—Main shaft down 1600 ft. and winze down 100 ft. About 100 lessees working in various parts of property.

LUCKY SHEPHERD (Tintic Jc.)—West Tintic property located several years ago by sheep herders to pass into control of interests operating Tintic Delaware.

Piute County

DEER TRAIL (Marysvale)—New 100-ton mill completed and ready for operation. Large tonnage of gold-silver-lead ore developed. Cyaniding and flotation to be used. Present length of tunnel 2200 ft. Salisburys, of Salt Lake, interested. Operation in charge of J. A. McCaskell.

Salt Lake County

EMMA COPPER (Alta)—Production from Jan. 1 to Oct. 31, 1917, 7051 tons, which returned $215,636 smelter net.

Summit County

PARK CITY SHIPMENTS for January were 205 cars of ore—113 over the Rio Grande and 92 over the Union Pacific. These cars aggregated 10,547 tons. The shippers were Ontario Silver Mining Co., 3533 tons; Judge Smelting and Mining Co., 2791; Silver King Coalition, 2417; Silver King Consolidated, 936; Daly West, 633; Iowa Copper, 42; New Quincy, 45; California-Comstock, 35, and American Flag, 117 tons.

PARK CITY KING (Park City)—Copper staining showing for last 100 ft. in new tunnel, which is in 350 feet.

NEW QUINCY (Park City)—During 1917, 409 ft. of development driven, joining Daly-Judge New Quincy line. Survey to be made to establish underground line.

Tooele County

DUGWAY SMELTER COMPANY (Salt Lake)—Proposed to build 100-ton smelter for Dugway district 55 miles from railroad at Faust station. Dugway Bertha, at which a strike has been reported, among properties to furnish ore. A. L. Thomas, Jr., president; Pierre Peugeot, construction engineer, and Otto Stahlman, consulting engineer.

Utah County

PACIFIC (American Fork)—Operating mill and making shipments.

WHIRLWIND (American Fork)—Property is in operation.

EARL-EAGLE (American Fork)—Crew of men sent up for resumption of work.

MINERAL FLAT (American Fork)—Work being done by hand, as air line destroyed. Raising started from tunnel at point 2700 ft. from portal.

MINERAL HILL (American Fork)—Raise in southwest up 190 ft. part of ground close to limestone-quartzite contact. Drifting along fissure being continued. Some mineralization showing.

WISCONSIN

Zinc-Lead District

WISCONSIN ZINC CO. (Platteville)—New 200-ton Copeland mill at Shullsburg has been put into service.

H. H. & K. (Platteville)—Drilling indicates zinc ore on the William Kraemer land adjoining the Blockhouse property to the southeast.

MILWAUKEE-LINDEN (Linden)—Nick Tredinick and others have taken an option on this property, including the Gilman mine at Linden.

M. & A. (Platteville)—H. C. George, representing Eastern interests, has obtained an option on the M. & A. mine, a newly developed property at Rewey.

BLOCKHOUSE (Platteville)—Mine development and churn-drill holes have blocked out a quarter mile run for this rich producer; 2000 tons of concentrates are held in bin.

BLEWETT (Galena, Ill.)—Recently proved up by drilling and will be opened up by shaft; the Burr Mining Co. will supply mill equipment in exchange for stock. Land, known as the Bill Blewett farm, embraces the famous old Buck and Doe, said to have been mined for lead by the Indians. J. H. Billingsley is manager.

CANADA

British Columbia

CANADA COPPER CORP. LTD. (Greenwood)—Copper production for January was 445,268 pounds.

Manitoba

PENNIAC REEF (Star Lake)—Property consists of five claims lying west of Falcon Lake. Closed down since 1915. Now under option to American capitalists. High-grade gold and platinum ore was found in drifting before operations were suspended.

Ontario

SILVER ORE SHIPMENTS over the T. & N. O. Ry. during January from Cobalt were: Aladdin Cobalt, 59.60 tons (2000 lb.); Beaver, 39.99; Buffalo, 363.97; Coniagas, 130.5; Dominion Reduction Co., 291.65; Hudson Bay, 32.47; Kerr Lake Mining Co., 29.89; LaRose, 119.18; McKinley-Darragh, 42.11; O'Brien, 129.40; Penn-Canadian, 31.43; Right-of-Way, 51.54; Temiskaming, 66.52; Trethewey, 70.35; Total, 1458.60 tons. From Kerr Lake: Miller Lake-O'Brien, 26.10. Grand total, 1484.70 tons. From Porquois Jc., Alexo mine, 812.85 tons of nickel ore.

COBALT SHIPMENTS during the week ending Feb. 15 were: Buffalo, 241,895 lbs.; McKinley-Darragh, 107,893; Dominion Reduction, 104,000; Penn-Canadian, 52,909; total, 506,697. The Nipissing was the only bullion shipper during the week. During the week ended Feb. 22, Cobalt shipments were. Buffalo, 240,965 lbs.; McKinley-Darragh, 86,592; Dominion Reduction, 82,000; O'Brien, 64,320; Kerr Lake, 59,408; total, 533,285 lbs. During the corresponding period the Mining Corporation sent out one heavy shipment of bullion consisting of 99 bars, 100,346.07 ounces, and valued at $85,670.46.

WHELPDALE (Porcupine)—Shaft down to 100 level and crosscuts being driven.

MINING CORPORATION OF CANADA (Cobalt)—Took over Moira Lake fluorspar mine, situated near Madoc.

GOLD RIDGE (Porcupine)—Crosscutting on 100 ft. level to pick up veins from the adjoining Whelpdale.

KENABEEK (Kenabeek)—Two veins carrying silver have been cut at a depth of 136 ft. Sinking will be continued to 296 ft.

DOME LAKE (Porcupine)—Large orebody found at 500 level of No. 3 vein and opened for over 110 ft. Ore from 400 level is being milled.

ALEXO NICKEL (Porquois Jc.)—During the month of January a total of 21 cars containing 1,625,700 lb. of nickel ore was shipped from the property to the Mond Nickel Co. at Coniston.

CASTLE (Gowganda)—On this property, which is under option to the Trethewey, of Cobalt, the work of erecting camp buildings is in progress. A mining plant has arrived at Elk Lake and will be brought in over the winter roads.

PETERSON LAKE (Cobalt)—Crosscut into vein containing low-grade silver ore. Plans completed for flotation plant to treat tailings from Seneca Superior operations. S. G. Foist is manager.

O'BRIEN (Cobalt)—A shaft has been completed on the southern end of the property adjoining the Nipissing boundary. A station has been cut at the 300 level and crosscutting started to connect with No. 6 shaft.

OPHIR (Cobalt)—Drift on 420 level along main vein encouraging. Vein ranges in width from three to five inches and in places six inches containing calcite smaltite and nicolite. Galena and argentite appear now at heading.

CANADIAN KIRKLAND—(Kirkland Lake)—Shaft on No. 2 vein is down 75 ft., where the vein shows visible gold ore assays from $3 to $12 per ton. On No. 1 vein a depth of 35 ft. has been reached with encouraging results.

PROVINCIAL (Cobalt)—Manager Redington announces capacity of mill to be enlarged to 50 tons per day and a flotation equipment ordered. Sufficient tonnage blocked out underground to keep mill in operation two years.

Quebec

DOMINION MOLYBDENITE (Quyon) Company is asking tenders or bids for sinking and timbering a 7 x 12 ft. shaft at 70° incline in syenite rock from present depth of 40 ft. to 200 ft.

PERU.

CERRO DE PASCO (Cerro de Pasco)—The new 4000-hp. hydro-electric installation at Pachachaca, near Oroya, is now nearing completion, the pipe lines having been laid and cement poured for the power house.

The Market Report

SILVER AND STERLING EXCHANGE

Feb. Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Feb.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
28	4.7530	85⅛	42⅛	4	4.7530	85⅛	42⅛
1	4.7530	85⅛	42⅛	5	4.7525	85⅛	42⅛
2	4.7530	85⅛	42⅛	6	4.7525	85⅛	42⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Feb. Mar.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
28	*23½	†	7½	7.20 @7.25	7.45 @7.50
1	*23½	†	7½	7.20 @7.25	7½
2	*23½	†	7½	7.20 @7.25	7½
4	*23½	†	7½	7.20 @7.25	7½
5	*23½	†	7½	7.20 @7.25	7½
6	*23½	†	7½	7.15 @7.20	7½

*Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

†No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17.5c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 13c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Feb. Mar.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
28	110	110	125	319	316	29½	54
1	110	110	125	319	316	29½	54
2							
4	110	110	125	318½	315½	29½	54
5	110	110	125	319	315½	29½	54
6	110	110	125	319	316	29½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515. £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—Mar. 6

The markets this week were unchanged and destitute of features of special interest.

Copper—The refineries are operating at greatly reduced capacity, owing to continued failure to receive blister copper.

The financial disarrangements are putting copper producers, especially the mining companies, in a very awkward position. With their blister copper twice the normal time en route, and with the tardiness of the U. S. Government, especially the War Department, in making payments (the delay being 60 days or more), producers find themselves obliged to finance anywhere from four months' to six months' production, and this on the present basis of high costs.

Press reports of the cessation of the Cerro de Pasco operations in Peru had not been confirmed in the company's New York offices up to 3 o'clock on Wednesday afternoon. As the company has received its regular cables, with no mention of trouble, the officials in New York are inclined to doubt that operations have ceased, as stated in the daily papers.

Copper Sheets are quoted at 31½c. per lb., f.o.b. mill, for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26½ to 26½c. f.o.b. mill, carload lots.

Tin—The situation remains fundamentally unchanged, but there is an increasing activity in Banka. However, this is in futures, for there are no spot supplies of Banka any more than there are of Straits. Last Thursday, 95c. was bid for a five-ton lot of Straits which was discovered. This bid was declined. However, it gives some indication of what the market might be.

Lead—The spot situation in New York is acute, there being no supplies here worth mentioning and no ability on the part of anybody to bring them here. Early in the week a few carloads were sold at 7⅞c., but later small quantities were offered at 7½c. With respect to the major market, producers offered lead freely at 7½c., for shipment, and today were offering at 7.17½c., St. Louis. During the most of the week the market was dull, but today there was more inquiry. There were some small orders from Japan in the market.

Zinc—Sales, small in the aggregate, were made from day to day at 7.50c., St. Louis. On Mar. 5 there was a considerable inquiry from galvanizers, which led some producers to advance their asking prices, but they failed to get the business.

Zinc Sheets—$15 per 100 lb., unchanged.

Other Metals

Aluminum—Much uncertainty; no price other than the Government price of 32c. per lb. is quoted.

The President has approved an agreement made by the War Industries Board with the producers of aluminum, fixing a maximum base price of 32c. per lb. at the various American plants and their subsidiaries, subject to revision on June 1, 1918; such price to cover lots of 50 tons and over of ingot of a grade 98 to 99%. The differentials now in force for the sundry grades, quantities and shapes will continue in force for new contracts. Deliveries under pre-existing contracts on "indirect government orders" at a base price in excess of 32c. per lb. shall be under such contracts, but the purchasing government, on proof of amount delivered, shall receive a rebate amounting to the difference between the contract price and the base price of 32c. per lb. The net weight of aluminum delivered to the governments, plus the weight of the necessary and proper amount of scrap, is to be used in figuring the amount of the rebate.

Deliveries which have been made on direct or indirect orders, subject to adjustments, shall be adjusted on the 32-cent basis. The conditions of the agreement are: (1)—That the producers will not reduce the wages now being paid. (2)—That they will sell to the Allies, to the public, and to the Government at the same price. (3)—That they will take the necessary measures, under the direction of the War Industries Board, for the distribution of the aluminum to prevent it from falling into the hands of speculators. (4)—That they pledge themselves to exert every effort necessary to keep up the production of aluminum so as to insure an adequate supply as long as the war lasts.

Antimony—This market was substantially unchanged. We quote spot at 13⅛@13¾c. Futures, 12⅞@12¾c., c.i.f., in bond.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.35 per lb. for wholesale lots—500 lb. and over. The market is quiet.

Cadmium—This metal is quoted at $1.50@1.75 per lb., depending on the quantity.

Nickel—Steady at 50c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—This market advanced. We quote $120@125. San Francisico reports, by telegraph, $117.50, steady.

Silver—The market continues very steady. London official returns are unchanged at 42⅛ since Feb. 22. Shipments last week for London were about 600,000 oz. There is inquiry from San Francisco on account of China occasionally, but new business is not in large volume.

Mexican dollars at New York: Feb. 28, 68; March 1, 68; March 2, 68; March 4, 68; March 5, 68; March 6, 68.

Platinum—Owing to the requisitioning of supplies by the Government on Mar. 1, there has been no market since then, and, consequently, we cannot quote.

Palladium—Strong at $140.

Zinc and Lead Ore Markets

Joplin, Mo., Mar. 2 — Blende, per ton, high, $66.90; basis 60% Zn, premium, $65@62.50; medium to low, $60@52.50; average, $58.75; calamine, 40% Zn, $40@35; average selling prices: Blende, $54.98; calamine, $37.84; all zinc ores, $54.04.

Lead: High, $87.60; basis 80% Pb, $87.50@86; average selling price, all grades of lead, $82.49 per ton.

Shipments the week: Blende, 7970; calamine, 460; lead, 1911 tons. Value, all ores the week, $613,320.

A stronger demand for zinc this week sent up lower grades $2.50 per ton, but other changes in prices were slight. Larger shipments of lower grade blende and calamine dropped the average prices sharply.

Platteville, Wis., Mar. 2 — (By telegraph)—Blende, per ton, basis 60% Zn, $61 base for premium grade down to $57 base for second grade. Lead ore, basis 80% Pb, $85 per ton. Shipments reported for the week are: 2188 tons of blende, 192 tons of galena and 848 tons of sulphur ore. For the year to date the figures are 18,735 tons of blende, 723 tons of galena and 4844 tons of sulphur ore. Shipment during the week was 3451 tons of blende to separating plants.

Manganese Ore—Quoted at $1.20@1.30 per unit for metallurgical ore of 48 o/o grade and upward.

Molybdenum Ore—Demand was light and, offerings being fairly free, quotations were a little easier. We quote 90 o/o grade at $2.10@2.20, 85 o/o grade at $2.05@2.15, and 80 o/o grade at $1.80.

Pyrites—Spanish lump is quoted at 15½c. per unit, on basis of 10s. ocean freight, buyer to pay express freight and war risk, except that, depending on conditions, concession of 2% of war risk may be allowed. Ocean rates remain at 35s. for Northern and 42s. 6d. for Southern ports. Cargo tonnage is scarce; only half the tonnage required in January was secured and the same condition ruled in February.

Tungsten Ore—Scheelite continues to be quoted at $26, but this is only nominal, no transactions being reported. Wolframite was unchanged at $20@24.

Iron Trade Review

PITTSBURGH—Mar. 5

While shipping conditions remain unsatisfactory and the production of finished steel has increased only to about two-thirds of capacity, the situation and prospects of the steel industry are much less uncertain than they were a month ago. The prospect has become so much clearer that in the event of physical conditions permitting full operation of the plants, there will not be enough ordinary commercial demand to absorb all the output that would be left after satisfying the war requirements.

The experience of practically all mills is that the requirements of customers, apart from the demand arising from war orders, are decidedly light, and when, as is

usually the case, the customers would prefer heavier deliveries than they have been receiving lately, the pressure is due to the fact that the deliveries have been extremely limited.

The Washington authorities are being converted to this view very slowly, finding it hard to depart from the position that steel will be scarce indefinitely, and obtainable with difficulty. An important fact, which may surprise some, is that manufacturers rarely, if ever, obtain through regular Government channels any information that supplies of steel furnished the various consuming points, shipyards, shell factories, etc., are sufficient or more than sufficient. They must ascertain that themselves, and many are employing men to make such investigations. From such investigations it has been ascertained that in many cases there is an oversupply of steel at consuming points.

Shipments of finished steel from mills are now averaging 65 to 70% of capacity. Production of finished steel is about 5% less, as the mills are endeavoring to reduce the unwieldy stocks accumulated during the railroad tie-up. Ingot production is much heavier, this arising from heavier pig iron production, it being better in many cases to stock ingots than pig iron. The increased pig-iron production arose chiefly through the dispatch during the last four weeks of coke that had been blocked en route. The shipments have not been sufficient to maintain the increased rate of pig-iron production, and blast furnace operations are now booked for a decrease unless coke shipments increase this week. The railroads promise the return of many empties from the East this week as a result of a partial clearing of the congestion there. These are to be put immediately into regular service in the coal and coke trade. The Youngstown district mills are now fully supplied with coal and refuse offers of coal brokers. Pittsburgh district consumers are fairly well supplied.

Pig Iron—Only a small tonnage of transactions entered into the February computation of averages made by W. P. Snyder & Co., but sufficient to establish the averages, which came out at the Government limits, $36.30, Valley, for bessemer and $33 for basic. The average for foundry iron in February may also be taken at $33, as there were a number of sales of small lots at this figure, while there was a moderate amount of contracting for forward delivery at the set price, with a proviso for modification in case of change by the Government. The market is now hardly more active than in February. Shipments on contracts are somewhat improved. The market is quotable at Government limits: Bessemer, $36 30; basic and foundry, $33; malleable, $33.50; forge, $32, f.o.b. furnace, freight from Valleys to Pittsburgh being 95c.

Steel—There is not much inquiry. Large supplies of discard steel, rolled to various sizes of billets, are available, subject to the difficulty of shipping. This steel commands a few dollars a ton under the set prices for soft steel, which remain: Billets, $47.50; small billets, $51; slabs, $50; sheet bars, $51; rods, $57.

Bar Iron Settlement — The bi-monthly settlement in connection with the sliding wage scale of iron mills disclosed that the average price received for base sizes of iron bars shipped from the selected mills in the Central West in the 60 days ended Feb. 20 was 3.10c., against 2.95c. in the preceding settlement. The puddling rate therefore advances from $14.30 per gross ton to $15.05. About July 1 last the quotation for bar iron, Chicago, advanced to 4.50c., while the Government price was set in November at 3.50c. The mills have been unable to realize even the Government price except on a relatively small proportion of their shipments.

Ferromanganese—The market is much stiffer, and even fair sized lots for prompt and forward shipment bring the full quoted price of $250, delivered. Producers are practically sold up in full to July 1.

Connellsville — Car supplies continue poor. Shipments have been increasing 5000 to 10,000 tons a week, but last week were only about 300,000 tons. While this is the best tonnage for many weeks, the requirements of the tributary furnaces are estimated at about 375,000 tons, or even 400,000 tons. Coke loaded in P. & L. E. cars is frequently offered in the market, but coke in other equipment, which is permitted to go further afield, is but rarely available. Set prices continue at $6 for furnace, $7 for foundry, 72-hour selected, and $7.30 for crushed, over 1-in. size. The Fuel Administration has granted advances over the usual set price for certain West Virginia cokes; also for one description of foundry coke make in Indiana County, Penn.

STOCK QUOTATIONS

N. Y. EXCH.†	Mar. 5
Alaska Gold M.	1⅛
Alaska Juneau	2⅛
Am.Sm.& Ref.,com.	80⅛
Am. Sm. & Ref., pf.	106
Am. Sm. Sec., pf., A	97
Am. Zinc	15⅛
Am. Zinc, pf.	45
Anaconda	62⅛
Batopilas Min	1⅛
Bethlehem Steel	79
Bethlehem Steel, pf.	101⅛
Butte & Superior	19⅛
Butte Cop. & Zinc	9⅛
Cerro de Pasco	31⅛
Chile Cop	16⅛
Chino	42⅛
Colo.Fuel & Iron	38
Crucible Steel	62⅛
Crucible Steel, pf.	89
Dome Mines	8⅛
Federal M. & S.	11
Federal M. & S., pf.	32⅛
Great Nor., ore ctf.	28⅛
Greene Cananea	40⅛
Gulf States Steel	‡92⅛
Homestake	‡81⅛
Inspiration Con	44⅛
International Nickel	29⅛
Kennecott	32⅛
Lackawanna Steel	80
Mexican Petrol	96⅛
Miami Copper	31⅛
Nat'l Lead, com.	54
National Lead, pf.	‡100
Nev. Consol	19⅛
Ontario Min	6⅛
Ray Con	24⅛
Republic I.&S.,com.	79⅛
Republic I. & S., pf.	‡98⅛
Sloss-Sheffield	‡50⅛
Tennessee C. & C.	16⅛
U. S. Steel, com.	91
U. S. Steel, pf.	110⅛
Utah Copper	81⅛
Va. Iron C. & C.	64

N. Y. CURB†	Mar. 5
Big Ledge	1.37½
Butte & N. Y.	.75
Butte Detroit	.56¼
Caledonia	.49
Calumet & Jerome	1.43⅛
Can. Cop. Corpn	2.06¼
Carlisle	‡2
Cashboy	.10
Con. Ariz. Sm.	2.00
Con. Coppermines	5.87½
Con. Nev.-Utah	.06⅛
Emma Con	‡1
First Nat. Cop.	2.06¼
Goldfield Con.	.40⅛
Goldfield Merger	.04
Greenmonster	.75
Hecla Min.	4.62½
Howe Sound	4.25
Jerome Verde	.68¾
Kerr Lake	5.50
Louisiana	.50
Magma	38.00
Majestic	.30
Marsh	.05½
McKinley-Dar-Sa	.51
Milford	‡1.25
Mohican	‡.25
Mother Lode	.32
N. Y. & Hond	12⅛
Nipissing Mines	8⅛
Nixon Nevada	1.06½
Ohio Cop.	1.00
Rawley	‡2⅛
Ray Hercules	4.62½
Richmond	‡.55
Rochester Mines	.40
St. Joseph Lead	.16
Standard S. L.	.40⅛
Stewart	.21⅛
Success	.09⅛
Tonopah	3.50
Tonopah Ex	1.62½
Tribullion	.31⅛
Troy Arizona	.20
United Cop	.56⅛
United Verde Ext.	‡39⅛
United Zinc	2⅛
Utica Mines	‡.08

SAN FRAN.*	Mar. 5
Alta	.02
Andes	.18
Best & Belcher	.02
Caledonia	.05
Challenge Con.	.03
Confidence	.04
Con. Virginia	.24
Gould & Curry	.01
Hale & Norcross	.01
Jacket-Cr. Pt.	.06
Mexican	.16
Occidental	.60
Ophir	.16
Overman	.01
Savage	.01
Sierra Nevada	.16
Union Con.	1.07½
Utah Con.	‡.01
Belmont	3.00
Jim Butler	.60
MacNamara	.13
Midway	.08
Mont.-Tonopah	.10
North Star	.05
Rescue Eula	.08
West End Con.	.87
Atlanta	.11
Booth	.04
Comb. Frac.	.02
D'field Daisy	‡.02
Florence	.14
Jumbo Extension	.14
Kewanas	.07
Nevada Hills	.05
Nevada Packard	.25
Round Mountain	.32
Silver Pick	.05
White Caps	.52
Big Jim	‡.75
United Eastern	4.75

BOSTON EXCH.*	Mar. 5
Adventure	1⅛
Ahmeek	80½
Algomah	.25
Allouez	.52
Ariz. Com., ctfs.	12⅛
Arnold	.20
Bonanza	.20
Butte-Balakiava	.29
Calumet & Aris	.68
Calumet & Hecla	435
Centennial	13⅛
Copper Range	45
Daly West	2⅛
Davis-Daly	6⅛
East Butte	9⅛
Franklin	6
Granby	74
Hancock	9
Hedley	11
Helvetia	15
Indiana	85
Isle Royale	21⅛
Keweenaw	1⅛
Lake	6⅛
La Salle	3⅛
Mason Valley	5
Mass	6
Mayflower	1⅛
Michigan	2⅛
Mohawk	62
New Arcadian	2⅛
New Idria	14
North Butte	15⅛
North Lake	.26
Ojibway	1⅛
Old Dominion	41
Osceola	59
Quincy	72
St. Mary's M. L.	54
Santa Fe	1⅛
Seneca	9⅛
Shannon	5⅛
Shattuck-Ariz.	18
So. Lake	1⅛
So. Utah	.17
Superior	4⅛
Superior & Bost.	2⅛
Trinity	4
Tuolumne	1⅛
U. S. Smelting	46
U. S. Smelt'g, pf.	45⅛
Utah Apex	2⅛
Utah Con.	10⅛
Utah Metal	2
Victoria	3
Winona	1⅛
Wolverine	33⅛
Wyandot	1⅛

BOSTON CURB*	Mar. 4
Alaska Mines Corp.	.20
Bingham Mines	9⅛
Boston Ely	.78
Boston & Mont.	.70
Butte & Lon'n Dev.	.11
Calaveras	1⅛
Calumet-Corbin	‡.01
Chief Con.	2 1/16
Cortes	.10
Crown Reserve	.20
Crystal Cop.	.47
Eagle & Blue Bell	2
Gila Copper	‡17
Houghton Copper	.75
Intermountain	‡.70
Iron Cap, Com	18⅛
Mexican Metals	.46
Mines of America	1⅛
Mojave Tungsten	.05
Nat. Zinc & Lead	.27
Nevada-Douglas	95
New Baltic	99
New Cornelia	16⅛
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	.10
Yukon Gold	.50

SALT LAKE*	Mar. 5
Bannack	‡.26
Cardiff	2.50
Colorado Mining	.08
Daly	1.40
Daly-Judge	6.00
Empire Copper	‡1.10
Gold Chain	.08
Grand Central	.55
Iron Blossom	.46
Lower Mammoth	‡.03
May Day	.02
Moscow	‡.02
Prince Con.	.53
Rico Wellington	.17
Silver-King Coal'n	2.65
Silver King Con.	2.80
Sioux Con.	.02
So. Hecla	.70
Tintic Standard	‡1.35
Uncle Sam	‡.01
Walker Cop.	1.67
Wilbert	.08
Yankee	.05

TORONTO*	Mar. 5
Adanac	.09
Bailey	‡.05
Beaver Con.	.24
Chambers Ferland	.19
Coniagas	3.25
Hargraves	.06
La Rose	.31
Peterson Lake	.09
Temiskaming	.26
Westlaufer-Lor.	.04
Davidson	.34
Dome Exten.	.09
Dome Lake	.25
Hollinger	5.00
McIntyre	1.37
Newray	.21
Porcu. Crown	.18
Teck-Hughes	.50
Vipond	.24
West Dome	.11

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Mar. 5
Cresson Con.	4.93¾
Doctor Jack Pot	.03⅛
Elkton Con.	.05
El Paso	.15
Gold Sovereign	.02⅛
Golden Cycle	1.71½
Granite	.40
Isabella	.07
Mary McKinney	.06⅛
Portland	1.05
United Gold M.	.15
Vindicator	.35½

LONDON	Feb. 7
Alaska G. F.	£0 1/6 6d
Burma Corp.	4 3 9
Cam & Motor	0 13 3
Camp Bird	0 7 6
El Oro	0 8 9
Esperanza	0 8 9
Mexican Mines	5 12 6
Min. Corp. Can.	0 15 9
Nechi, pfd	0 9 9
Oroville	0 18 9
Santa Gert'dis.	0 13 6
Tomboy	0 19 6

* Bid prices. † Closing prices. ‡ Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.682	44.336
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.935	73.861		27.597	36.410	
April	64.415	73.875		30.662	36.963	
May	74.269	74.745		35.477	37.940	
June	65.024	76.971		31.060	39.065	
July	62.940	79.010		30.000	40.110	
Aug.	66.083	85.407		31.498	43.418	
Sept.	68.515	100.740		32.584	50.920	
Oct.	67.855	87.332		32.361	44.324	
Nov.	71.604	85.891		34.192	43.584	
Dec.	75.765	85.960		36.410	43.052	
Year	65.661	81.417		31.315	40.851	

New York quotations cents per ounce troy, fine silver. London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28.673	23.500	131.921	110.000	142.895	125.000
Feb.	31.750	23.500	137.895	110.000	148.100	125.000
Mar.	31.481		136.750		151.000	
April	27.935		133.842		147.158	
May	28.788		130.000		142.000	
June	29.962		130.000		142.000	
July	26.620		128.409		140.409	
Aug.	25.380		122.391		137.000	
Sept.	25.073		117.500		135.250	
Oct.	23.500		110.000		125.000	
Nov.	23.500		110.000		125.000	
Dec.	23.500		110.000		125.000	
Year	27.180		124.892		138.401	

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	(a)	185.813	293.227
February	51.420	(a)	198.974	311.525
March	54.388		207.443	
April	55.910		220.171	
May	63.173		245.114	
June	62.053		242.083	
July	62.570		242.181	
August	62.681		243.978	
September	61.542		244.038	
October	61.851		247.467	
November	74.740		274.943	
December	87.120		298.556	
Av. year	61.802		237.563	

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7.530	6.684	30.500	29.50
February	8.636	6.973	8.595	6.899	30.500	29.50
March	9.199		9.120		30.500	
April	9.288		9.158		30.500	
May	10.207		10.202		30.500	
June	11.171		11.123		30.500	
July	10.710		10.644		30.500	
August	10.594		10.518		30.500	
September	8.680		8.611		30.500	
October	6.710		6.650		30.500	
November	6.249		6.187		30.500	
December	6.375		6.312		30.500	
Year	8.787		8.721		30.500	

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300		10.130		47.000	
April	9.459		9.289		54.632	
May	9.362		9.192		54.000	
June	9.371		9.201		54.000	
July	8.643		8.473		54.000	
August	8.360		8.190		54.000	
September	8.136		7.966		54.000	
October	7.983		7.813		54.000	
November	7.847		7.672		54.000	
December	7.685		7.510		54.000	
Year	8.901		8.813		52.413	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35.95	$37.25	$30.95	$33.95	$30.95	$33.95
February	36.37	37.25	30.95	33.95	30.95	33.95
March	37.37		33.49		35.91	
April	42.23		38.90		40.06	
May	46.94		42.84		43.60	
June	54.22		50.05		50.14	
July	57.45		53.80		53.95	
August	54.17		50.37		53.95	
September	46.40		42.24		48.58	
October	37.25		33.95		33.95	
November	37.25		33.95		33.95	
December	37.25		33.95		33.95	
Year	$43.57		$39.62		$40.83	

‡ As reported by W. P. Snyder & Co.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots, Pittsburgh	St. Louis	Chicago	San Francisco	New York Mar. 5, 1918	New York One Yr. Ago
No. 10	4.25	5.52	5.45	6.00	5.45	6.00
No. 12	4.30	5.57	5.50	6.05	5.50	6.05
No. 14	4.35	5.62	5.55	6.10	5.55	6.10
Black						
Nos. 18 and 20	4.80	6.32	6.25	6.90	6.25	6.30
Nos. 22 and 24	4.85	6.37	6.30	6.95	6.30	6.35
No. 26	4.90	6.42	6.35	7.00	6.44	6.40
No. 28	5.00	6.52	6.45	7.10	6.45	6.50
Galvanized						
No. 10	5.25	6.97	6.80	....	6.70	7.10
No. 12	5.35	6.97	6.80	7.45	6.80	7.15
No. 14	5.35	6.97	6.80	7.45	6.80	7.20
Nos. 18 and 20	5.65	7.17	7.10	7.70	7.10	7.50
Nos. 22 and 24	5.80	7.32	7.25	7.90	7.25	7.70
No. 26	5.95	....	7.40	8.05	7.40	7.95
No. 28	6.25	7.77	7.70	8.35	7.70	8.25

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Mar. 1, 1918	Pittsburgh One Year Ago	Chicago* Mar. 1, 1918	Chicago* One Year Ago
Standard bessemer rails	60.00-65.00	38.00	60.00-65.00	38.00
Standard openhearth rails	63.00-65.00	40.00	63.00-65.00	40.00
Light rails, 8 to 10 lb.	*3.135	53.00	*3.135	47.00
Light rails, 12 to 14 lb.	*3.09	52.00	*3.09	46.00
Light rails, 25 to 45 lb.	*3.00	50.00	*3.00	44.00

*Government price per 100 lb. for rails rolled from billets.

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Mar. 1, 1918	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, ⅝-in. and larger	$3.90	$3.40	$4.50	$5.30	$6.25
Track bolts	4.90	5.00	5.50	Premium	7.45
Standard section angle bars	3.25	2.25–2.75	4.50	Premium	4.56

STRUCTURAL MATERIAL—The following are the base prices f.o.b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill, Pittsburgh	New York Mar. 5, 1918	New York 1 Yr. Ago	St. Louis	Chicago	San Francisco	Dallas
Beams, 3 to 15 in.	$3.00	$4.195	$3.95	$4.27	$4.20	$4.75	$5.50
Channels, 3 to 15 in.	3.00	4.195	3.95	4.27	4.75	4.20	5.50
Angles, 3 to 6 in., ¼ in. thick	3.00	4.195	3.95	4.27	4.75	4.20	5.50
Tees, 3 in. and larger	3.00	4.195	3.95	4.27	4.75	4.25	5.50
Plates	3.25	4.445	4.75–5	4.52	5.00	4.45	6.00

STEEL SHEET PILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Mar. 5, 1918	One Month Ago	One Year Ago
$4.00 to $5.00	$4.00 to $5.00	$3.00

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Mill, Pittsburgh	New York Feb. 5, 1918	New York One Year Ago	Chicago	St. Louis	San Francisco	Dallas
Warehouse							
⅝ in. and larger	$5.25	$7.00	$5.25	$5.50	$5.55	$6.65	$8.00
CONE HEAD BOILER							
½ in. and larger	5.35	7.10	5.35	5.60	5.65	6.75	8.00
⅜ and 11/32	5.50	7.25	5.50	5.75	5.80	6.90	8.15
½ and 17/32	5.85	7.60	5.85	6.10	6.15	7.25	8.50

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	List + 20%
Galvanized cast steel rigging	Net List
Bright plow steel	30%
Bright cast steel	17½%
Bright iron and iron tiller	5%

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$5.25	$6.30	$6.00	$6.00	$7.50	$6.25
Assorted	5.40	6.30	6.00–6.50	6.25	7.75	6.50

STRUCTURAL MATERIAL—The following are the base prices f.o.b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill, Pittsburgh	New York Mar. 1, 1918	New York 1 Yr. Ago	Chicago	Dallas	San Francisco	St. Louis
Beams, 3 to 15 in.	$3.00	$4.195	$3.95	$4.20	$5.50	$4.75	$4.27
Channels 3 to 15 in.	3.00	4.195	3.95	4.20	5.50	4.75	4.27
Angles, 3 to 6 in., ¼ in. thick	3.00	4.195	3.95	4.20	5.50	4.75	4.27
Tees, 3 in. and larger	3.00	4.195	3.95	4.25	5.50	4.75	4.27
Plates	3.25	4.445	5.00	4.45	6.00	5.00	4.52

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh:

Iron bars ..... 3.5c. Steel bars ..... 2.9c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0.16½	$0.16	$0.12	$0.17	$0.12

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham
Solid	14c.	14c.	15c.
Hollow	24c.	25c.	...

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh, basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

BUTT WELD

Steel Inches	Black	Galvanized	Iron Inches	Black	Galvanized
⅜, ¼ and ⅝	44%	17%	¾ to 1½	33%	17%
½	48%	33½%			
¾ to 3	51%	37½%			
LAP WELD					
2	44%	31½%	2	36%	12%
2½ to 6	47%	34½%	2½ to 4	28%	15%
			4½ to 6	28%	15%
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅜, ¼ and ⅝	40%	22½%	¾ to 1½	33%	18%
½	45%	32½%			
¾ to 1½	49%	36½%			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	42%	30½%	2	27%	14%
2½ to 4	45%	33½%	2½ to 4	29%	17%
4½ to 6	44%	32½%	4½ to 6	28%	16%

Note—National Tube Co. quotes on basing card dated Apr. 1.

From warehouses at the places named the following discounts hold for steel pipe:

Black	New York	Chicago	St. Louis
¾ to 3 in. butt welded	38%	42.8%	40.1%
3½ to 6 in. lap welded	18%	38.8%	36.1%
Galvanized			
¾ to 3 in. butt welded	22%	27.8%	25.1%
3½ to 6 in. butt welded	List	18.8%	22.1%

Malleable fittings, Class B and C, from New York stock sell at list price. Cast iron, standard sizes, 15 and 5%.

MISCELLANEOUS

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels:

	New York	Chicago	Denver In Bbl. Lots	Denver In Carload Lots
Pure steam-distilled pine oil	$0.50½	$0.50	$0.30	$0.27
Pure destructively distilled pine oil	.48	.48	.30	....
Pine tar oil	.36	.40	.24½	.19
Crude turpentine	.37	.52	.44	.38
Hardwood creosote	.19½*	....	.34½	.31

*F.o.b. Cadillac, Mich.

SODIUM CYANIDE—New York price is 37c. per lb.; Denver, 44c.; in Chicago, 45c.; in St. Louis, 40c.

SODIUM SULPHIDE—In New York the price per pound is 4c. to 4¼c. for concentrated, 2¼c. to 2½c. for crystals. The Denver price for crystals is quoted at 9c.; the St. Louis price, 4c. for concentrated, the Chicago price is 4½c. Concentrated comes in 500-lb. drums, the crystals in 440-lb. bbl.

ZINC DUST—New York price is 18c. per lb. in 1600-lb. barrel; Chicago, 18c.; in Denver, 13c. f.o.b. Pueblo; in St. Louis, 25c.

ALUMINUM DUST—Chicago price is $1 per lb.

CALCIUM CARBIDE—Price f.o.b. cars at warehouse points east of Mississippi River (except in Alabama, Georgia and Florida) is $97.50 for Cameo, $102.50 for Union miners' carbide. In territory between Mississippi River and the Rockies and in Alabama, Georgia and Florida, add $5; west of Rockies, add $10 to $15.

LINOLEUM—In 50-sq.yd. rolls in carload lots the price is $1 per square yard, for concentrating tables.

HOSE—

Fire

	50-Ft. Lengths
Underwriters' 2½-in.	75c. per ft.
Common, 2½-in.	40%

Air

	First Grade	Second Grade	Third Grade
¾-in. per ft.	$0.55	$0.30	$0.25

Steam—Discounts from list

First grade.... 30% Second grade....30-5% Third grade..40-10%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition ..... 50% Best grade 30%
Standard 35%

LEATHER BELTING—Present discounts from list in the following cities are as follows for cut lengths:

	Medium Grade	Heavy Grade
New York	40%	35%
St. Louis	45%	40%
Chicago	30—10%	40—5%
Birmingham	35%	40%
Denver	40%	40%

RAWHIDE LACING—40%.

MANILA ROPE—For rope smaller than ⅝-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ⅜-in., 8 ft.; ½-in., 6; ⅝-in., 4½; 1-in., 3½; for ¾-in. and larger, in 1200-ft. coils: 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound

Boston	$0.34½	Denver	$0.35½
New York	.35	Kansas City	.33½
Cincinnati	.33	New Orleans	.33
Chicago	.32½	San Francisco	.31
St. Paul	.34	Seattle	.33½

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0.90
Asbestos for high-pressure steam	1.60
Duck and rubber for piston packing	1.00
Flax, regular	.90
Flax, waterproofed	1.10
Compressed asbestos sheet	1.00
Wire insertion asbestos sheet	1.20
Rubber sheet	.60
Rubber sheet, wire insertion	.90
Rubber sheet, duck insertion	.50
Rubber sheet, cloth insertion	.25
Asbestos packing, twisted or braided, and graphited, for valve stems and stuffing boxes	1.10
Asbestos wick, ½- and 1-lb. balls	.70

FIRE BRICK—Quotations on the different kinds in the cities named are as follows, f.o.b. works:

	New York	Chicago
Silica brick, per 1000	$50.00 to 55.00	$55.00 to 60.00
Fire clay brick, per 1000, No. 1	45.00 to 55.00	.....
Magnesite brick, per net ton	135.00 to 145.00	.....
Chrome brick, per net ton	135.00	.....
Deadburned magnesite brick, per net ton	85.00 to 90.00	.....
Special furnace chrome brick, per net ton	60.00 to 70.00	60.00 to 80.00

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.

St. Louis—High grade, $55 to $65; St. Louis grade, $40 to $50.

Birmingham—Fire clay, $25 to $30; Denver, $23, per 1000.

RAILWAY TIES—For fair-size orders, the following prices per tie hold:

	Material	7 in. x 9 in. by 8 Ft. 6 In.	6 in. x 8 in. by 8 Ft.
New York	Yellow Pine	$1.30	$1.06 to 1.11
No. 1 White Oak	St. Louis	1.00	.75
Chicago	White Oak—Plain	1.00	.85
Chicago	White Oak—Creosoted	1.35	1.15
San Francisco	Douglas Fir—Green	1.21	.86
San Francisco	Douglas Fir—Creosoted	2.12	1.52

GREASES—Prices are as follows in the following cities in cents per pound for barrel lots:

	Cincinnati	Chicago	St. Louis	Birmingham	Denver
Cup	7	5¼	6.1	7½	10
Fiber or sponge	8	6	6.4	7½	15
Transmission	7	6	6.4	7½	15
Axle	4½	4	3.3	....	5
Gear	4½	4½	6.5	7½	6
Car journal	22 (gal.)	3½	4.6	7½	6

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Mar. 5, 1918	One Year Ago		
White	11.00 to 13.00	10.00 to 12.00	16.00	14.00 to 15.00
Colored mixed	8.50 to 12.00	7.00 to 9.00	14.00	10.00 to 12.00

WIPING CLOTHS—In Cleveland the jobbers' price per 1000 is as follows:

13¼ x 13¼ ..... $35.00 13¼ x 20½ $45.00

In Chicago they sell at $30 to $33 per 1000.

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Mar. 7, 1918	One Year Ago	Mar. 7, 1918	One Year Ago	Mar. 7, 1918	One Year Ago
Raw per barrel	$1.51	$0.99	$1.52	$1.00	$1.53	$0.98
5-gal. cans	1.61	1.09	1.62	1.10	1.63	1.08

WHITE AND RED LEAD in 500-lb. lots sell as follows in cents per pound:

	Red				White			
	Mar. 1, 1918		1 Year Ago		Mar. 1, 1918		1 Yr. Ago	
	Dry	In Oil	Dry	In Oil	Dry	Dry and In Oil	Dry	Dry and In Oil
25- and 50-lb. kegs	11.50	11.00	10.50	11.00	10.50		10.50	
12½-lb. keg	11.75	11.25	10.75	11.25	10.75		10.75	
100-lb. keg	11.25	11.50	11.00	11.50	11.00		11.00	
1- to 5-lb. cans	13.25	13.00	12.50	12.50	13.00		12.50	

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Mar. 5, 1918	One Year Ago	Mar. 5, 1918	One Year Ago	Mar. 5, 1918	One Year Ago
Hot pressed square	$1.00	$0.50	$1.40	$2.60	$1.05	$3.00
Hot pressed hexagon	1.00	.50	1.20	2.60	.85	3.00
Cold punched square	1.00	.50	.75	3.00	1.00	2.50
Cold punched hexagon	1.00	.50	.75	3.00	1.00	3.00

Semifinished nuts sell at the following discounts from list price:

	Feb. 5, 1918	One Year Ago
New York	40%	50%
Cleveland	60%	50—10%
Chicago	50%	50—10%
St. Louis	50—10%	.....

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago	St. Louis
¾ by 4 in. and smaller	30%	50%	40—10%	40%
Larger and longer up to 1 in. by 30 in.	15%	40%	30—5%	30—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

New York..$1.00 Cleveland..$2.00 Chicago..$3.00 St. Louis..$3.00

For cast-iron washers the base price per 100 lb. is as follows:

New York..$5.00 Cleveland..$4.50 Chicago..$3.50 St. Louis..$2.75

EXPLOSIVES—Price per pound in small lots at cities named:

	Low Freezing	Gelatin			Black Powder
	20%	40%	60%	80%	
New York	.....	$0.27½	$0.34½	.....	$2.50
Boston	.....	.....	.72½	$0.87½	....
Cincinnati	$0.21¾	.23¾	.28¾	.....	....
Kansas City	.20	.26¼	.33¼	.43¼	....
New Orleans	.....	.24½	.29½	.....	....
Seattle	.18½	.24¾	.31¾	.41¾	....
Chicago	.19¾	.23¾	.33	.43	2.35
St. Paul	.20	.26¼	.33¼	.....	2.45
St. Louis	.16½	.20½	.29½	.39½	2.15
Denver	.19	.25¼	.32¼	.42¼	....
Dallas	.25	.31½	.39	.49	....
San Francisco	.17½	.23½	.30½	.40½	....

FUEL OIL—Price variable, depending upon stock. New York quotations not available owing to this fact. In Chicago and St. Louis the following prices are quoted:

	Chicago	St. Louis
Mexican heavy, 12-14 Baumé	7c.	7⅛c.
Domestic light, 22-26 Baumé	5%	none

Note—There is practically no fuel oil in Chicago at present time.

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f.o.b. New York or Chicago:

	Carload Lots	Less Than Carload Lots
Tar felt (14 lb. per square of 100 sq.ft.)	$61.00	$62.00
Tar pitch (in 400-lb. bbl.)	15.00	16.50
Asphalt pitch (in barrels)	29.00	30.50
Asphalt felt	60.00	62.00

PREPARED ROOFINGS—Standard grade rubbered surface complete with nails and cement costs per square as follows in New York and Chicago:

	1-Ply		2-Ply		3-Ply	
	c.l.	l.cl.	c.l.	l.cl.	c.l.	l.cl.
No. 1 grade	$1.15	$1.40	$1.45	$1.60	$1.75	$1.90
No. 2 grade	1.10	1.25	1.25	1.40	1.50	1.65

Asbestos asphalt saturated felt (14 lb. per square) costs $5.35 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $1.85 per roll in carload lots and $2.10 for smaller quantities.

Shingles, red and green slate finish, cost $4.75 per square in carloads, $5 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4x12x12	8x12x12	12x12x12
Boston	$0.08	$0.15	$0.20
St. Paul	.056	.11	.162
Cincinnati	.0688	.129	.174
Kansas City	.058	.112	.1575
Denver	.11	.20	.30
New Orleans	.1155	.1771	.2329
Seattle	.07	.11	.16

LUMBER—Price per M in carload lots:

	8 x 8-in. x 20 Ft. and Under				12 x 12-In., 20 Ft. and Under
	Y.P.	Fir	Hemlock	Spruce	Y.P.	Fir
Boston	$52.50	$52.50	....	$40.00	$60.00	$60.00
Cincinnati	35.00	....	....	....	35.00	....
Denver	....	36.00	....	32.00	....	39.00
Kansas City	35.25*	34.00*	....	....	39.75*	35.00*
Seattle	23.00	23.00	23.00	23.00	23.00	23.00
New Orleans	28.00	....	....	....	36.00	....
St. Paul	....	49.00	40.00	40.00	....	57.00

*Kansas City—These quotations are for No. 1 common.

	1-In. Rough, 10 In. x 16 Ft. and Under		2-In. T. and G. 10 In. x 16 Ft.	
	Y.P.	Hemlock	Y.P.	Fir
Boston	$45.00	....	$50.00	$50.00
Cincinnati	35.00	....	37.50	....
Denver	35.00	$32.00	....	32.00
Kansas City	44.25	50.00	52.50	53.00
Seattle	23.00	23.00	23.00	32.00
New Orleans	35.00	....	35.00	....
St. Paul	....	46.00	39.00	61.00	38.50

PORTLAND CEMENT—These prices are for barrels in carload lots, including bags:

	Mar. 5, 1918	One Month Ago	One Year Ago
New York	$2.25	$2.22	$1.72
Jersey City	2.16	2.16	1.60
Boston	2.37	2.77	1.92
Chicago	2.21	2.31	1.86
Pittsburgh	2.31	2.31	1.81
Cleveland	2.44	2.44	1.94
Denver	3.20	3.20	....

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$16.50	$13.50	$2.10	$1.90
Chicago	15.00	12.00	1.90	1.60
St. Louis	13.00	....	....	1.50
Dallas	16.50	....	....	....
San Francisco	17.00	....	....	1.65
Boston	16.50	14.50	2.75	2.40
Kansas City	21.20	19.20	2.00*	1.90*
St. Paul	17.00	14.00	1.20*	1.10*
Seattle	18.00	....	....	1.80*

*Per 180-lb. barrel. †Birmingham, 200-lb. barrels.

Denver—There is one classification of hydrated lime, quoted at $21.25 per ton, paper bags. Lump lime sells for 65c. per bushel of 80 lb., in bulk or barrel weights.

Note—Refund of 10c. per bag, amounting to $2 per ton.